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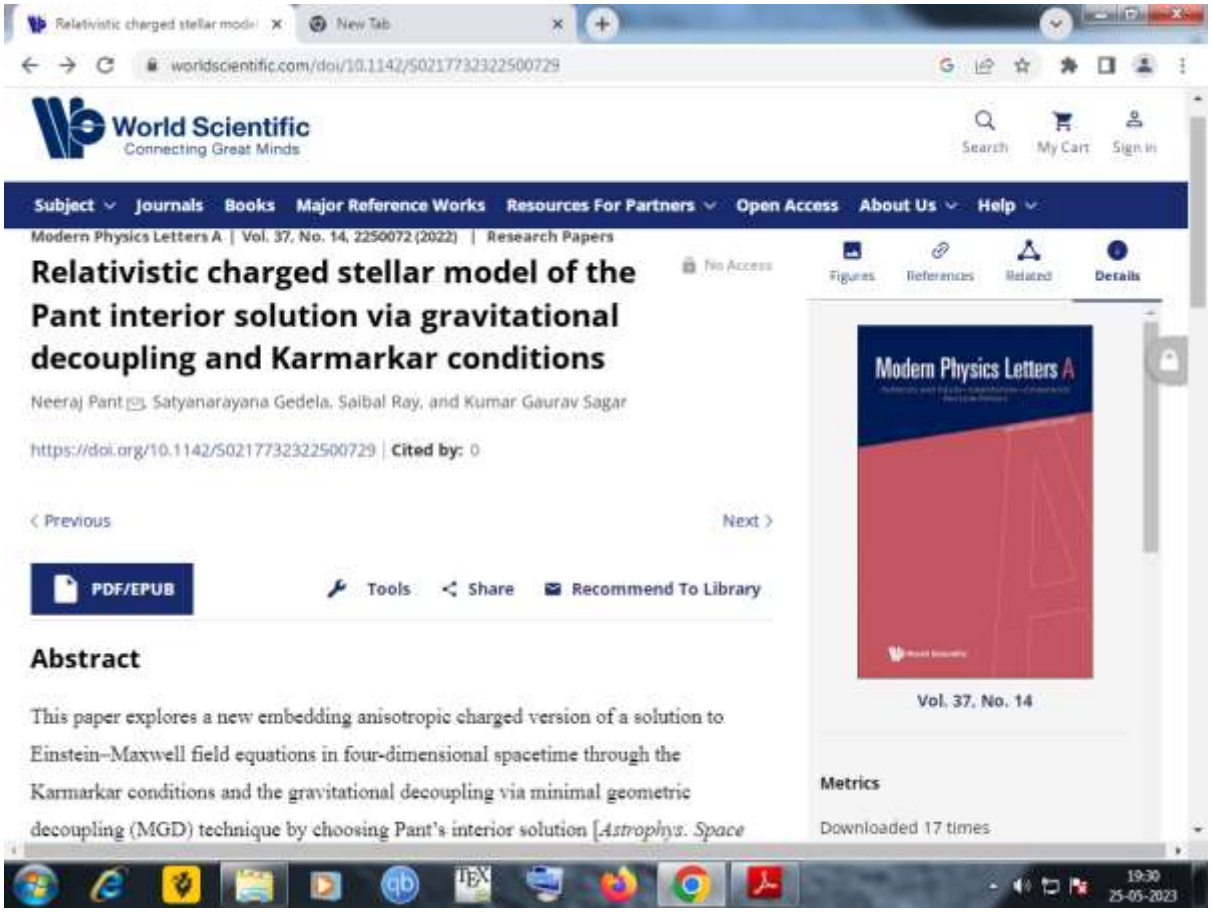

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Neeraj Pant, Satyanarayana Gedela, Saibal Ray, and Kumar Gaurav Sagar

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Abstract

This paper explores a new embedding anisotropic charged version of a solution to Einstein–Maxwell field equations in four-dimensional spacetime through the Karmarkar conditions and the gravitational decoupling via minimal geometric decoupling (MGD) technique by choosing Pant's interior solution [*Astrophys. Space*

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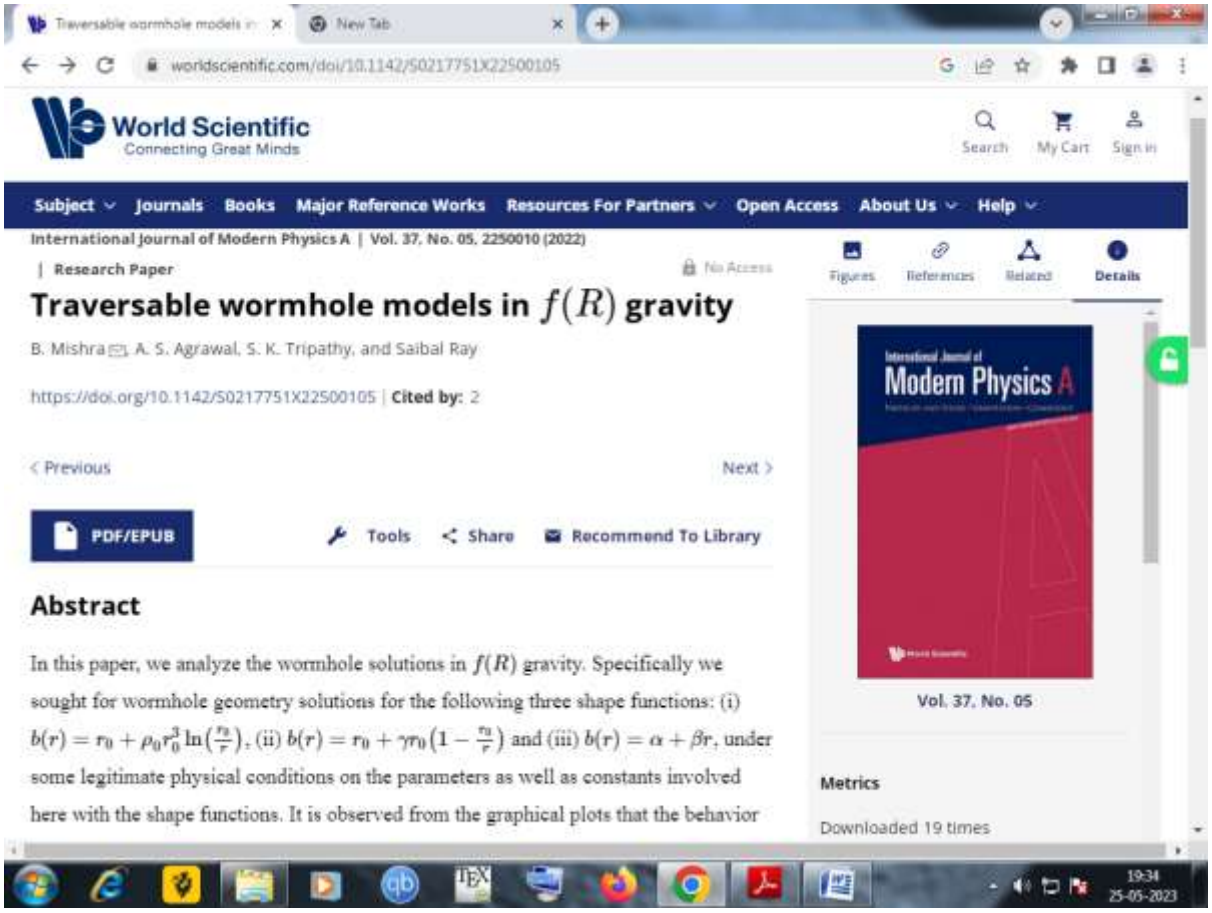
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In this paper, we analyze the wormhole solutions in $f(R)$ gravity. Specifically we sought for wormhole geometry solutions for the following three shape functions: (i) $b(r) = r_0 + \rho_0 r_0^3 \ln\left(\frac{r_0}{r}\right)$, (ii) $b(r) = r_0 + \gamma r_0\left(1 - \frac{r_0}{r}\right)$ and (iii) $b(r) = \alpha + \beta r$, under some legitimate physical conditions on the parameters as well as constants involved here with the shape functions. It is observed from the graphical plots that the behavior
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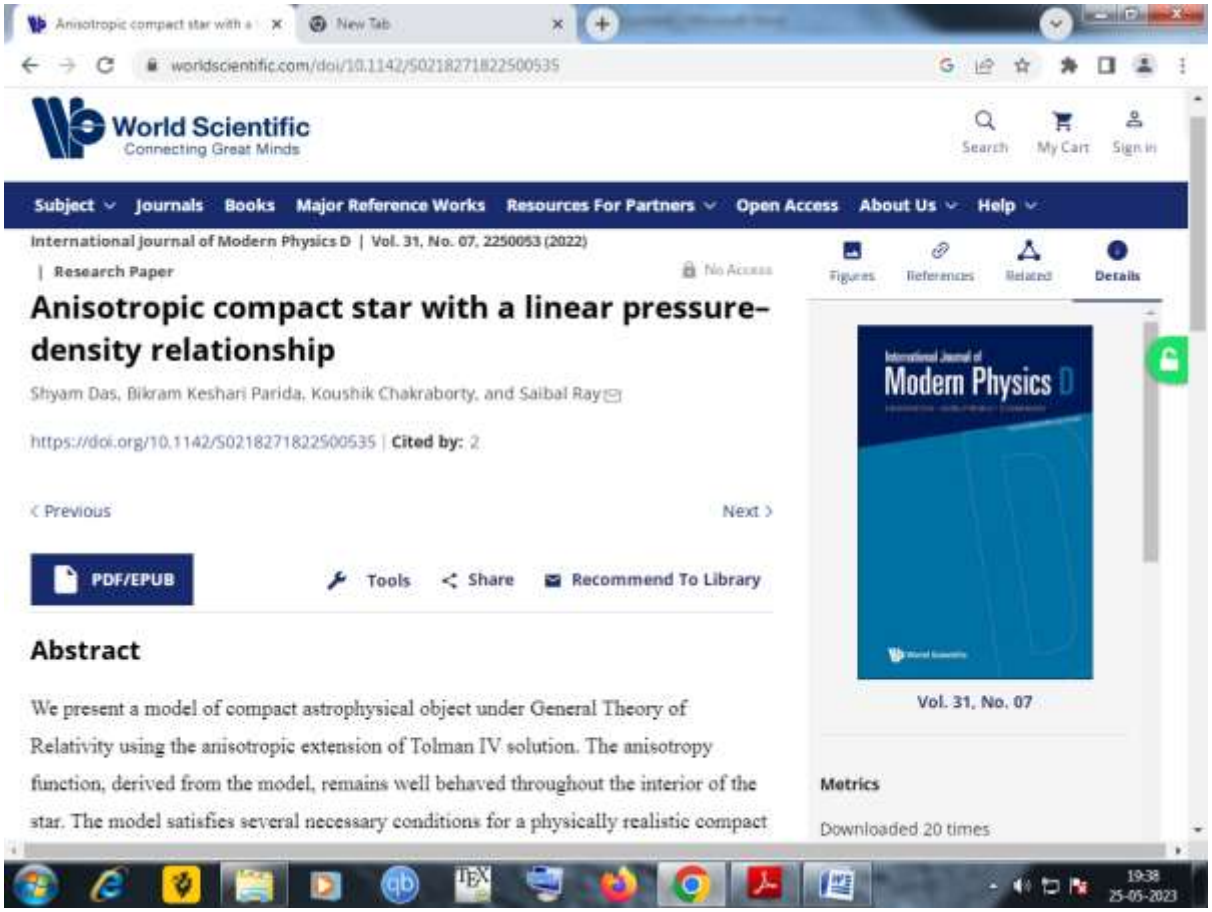
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We present a model of compact astrophysical object under General Theory of Relativity using the anisotropic extension of Tolman IV solution. The anisotropy function, derived from the model, remains well behaved throughout the interior of the star. The model satisfies several necessary conditions for a physically realistic compact
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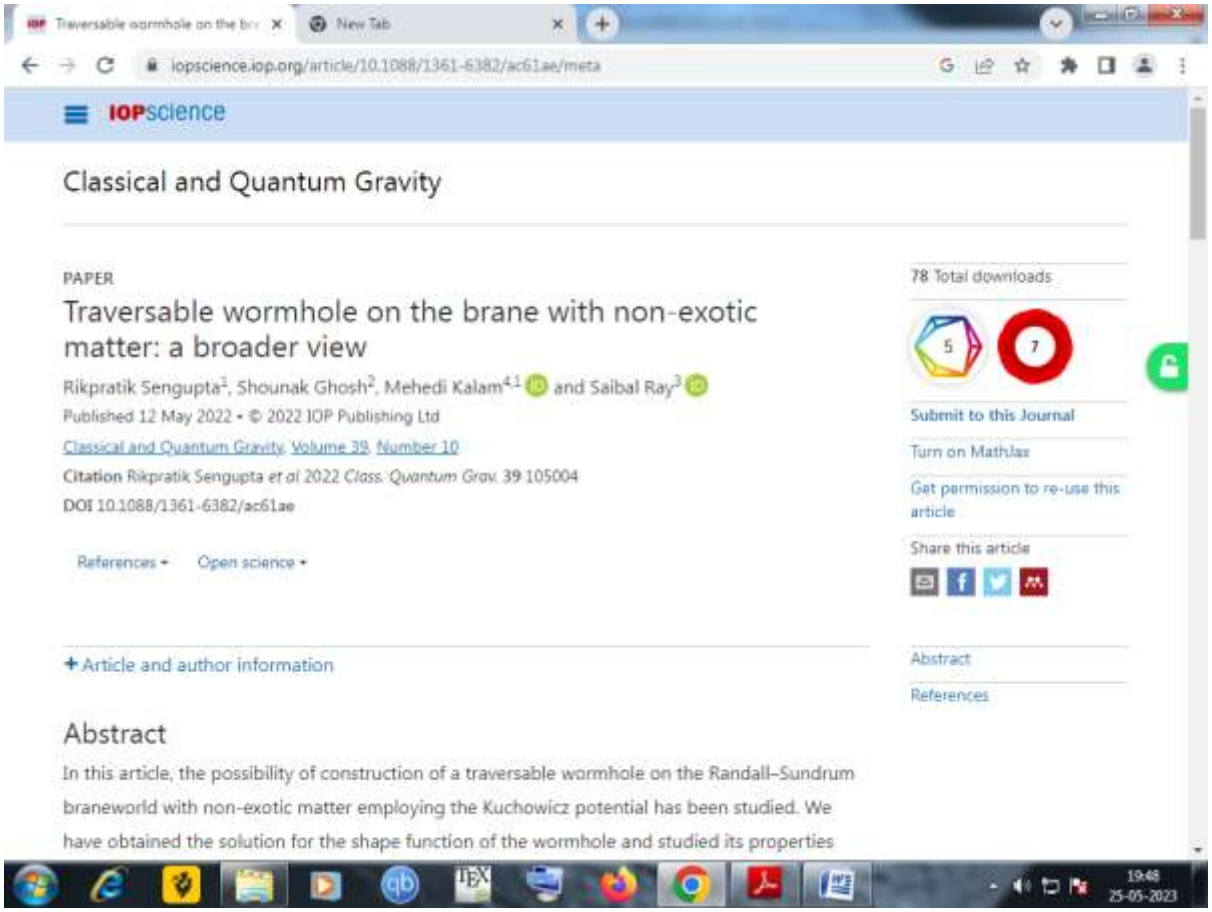
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Rikpratik Sengupta[1], Shounak Ghosh[2], Mehedi Kalam[4,1] and Saibal Ray[3]
Published 12 May 2022 • © 2022 IOP Publishing Ltd
Classical and Quantum Gravity, Volume 39, Number 10
Citation Rikpratik Sengupta et al 2022 Class. Quantum Grav. 39 105004
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Abstract
In this article, the possibility of construction of a traversable wormhole on the Randall–Sundrum braneworld with non-exotic matter employing the Kuchowicz potential has been studied. We have obtained the solution for the shape function of the wormhole and studied its properties
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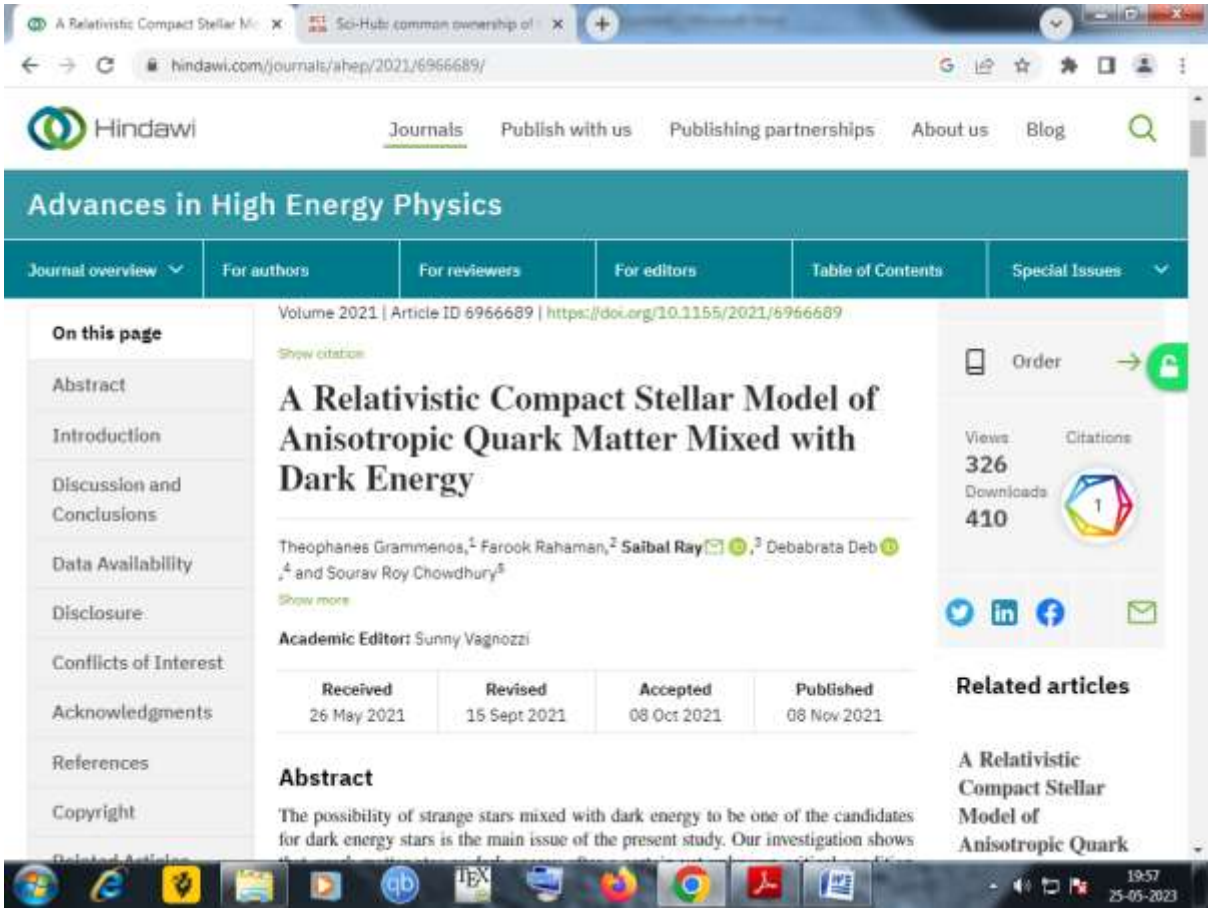
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Theophanes Grammenos,[1] Farook Rahaman,[2] Saibal Ray,[3] Debabrata Deb,[4] and Sourav Roy Chowdhury[5]
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Abstract
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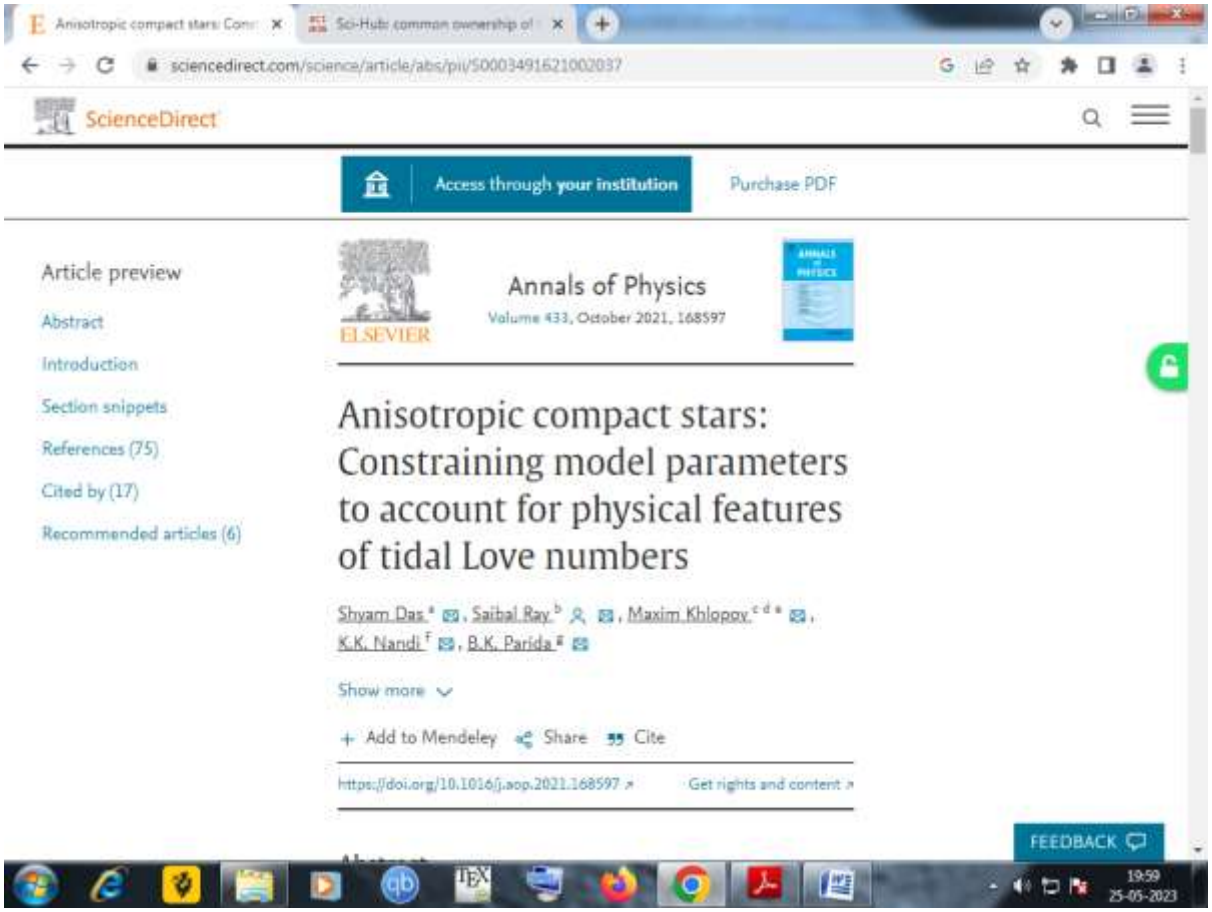
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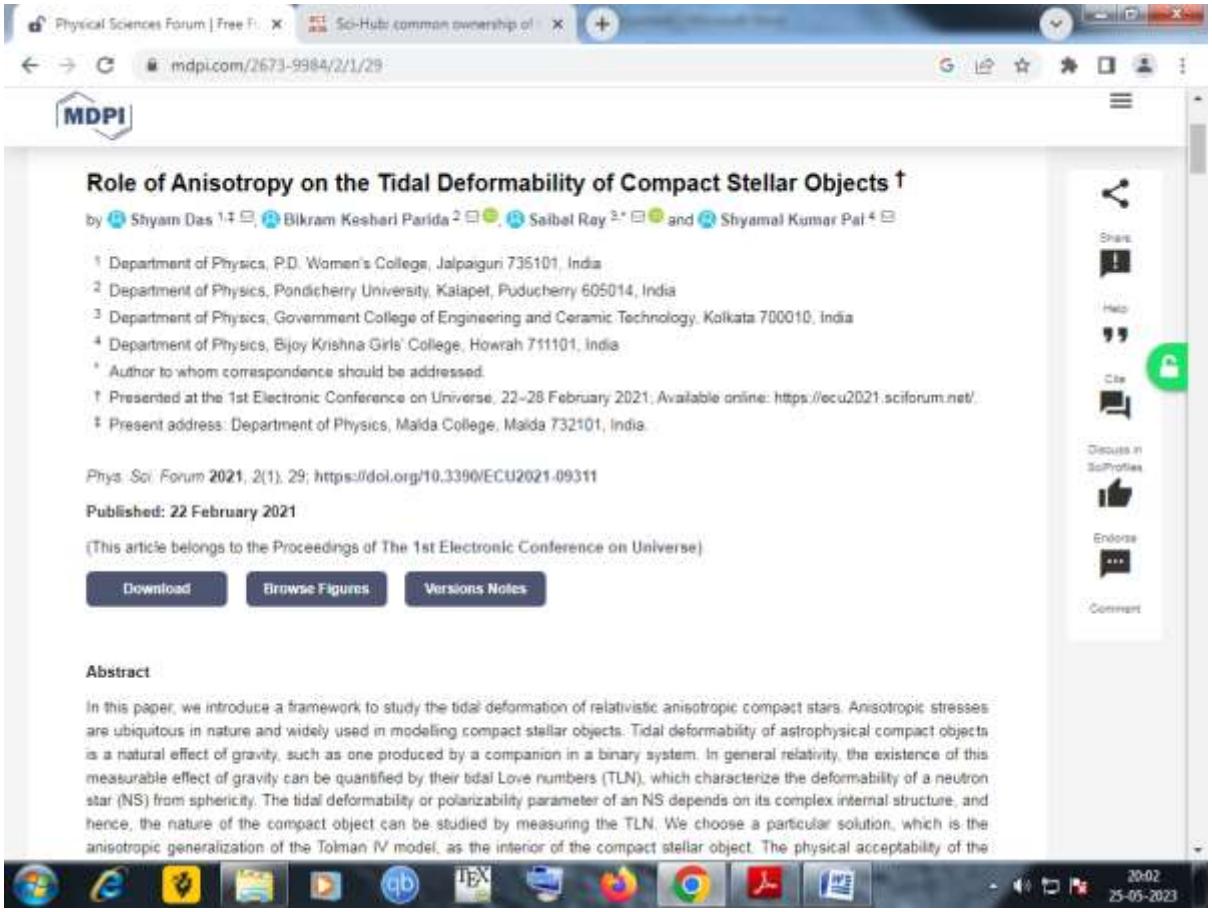

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Role of Anisotropy on the Tidal Deformability of Compact Stellar Objects †

by Shyam Das [1,‡], Bikram Keshari Parida [2], Saibal Ray [3,*] and Shyamal Kumar Pal [4]

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[4] Department of Physics, Bijoy Krishna Girls' College, Howrah 711101, India
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† Presented at the 1st Electronic Conference on Universe, 22–28 February 2021; Available online: https://ecu2021.sciforum.net/.

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Phys. Sci. Forum **2021**, *2*(1), 29; https://doi.org/10.3390/ECU2021-09311

Published: 22 February 2021

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Abstract

In this paper, we introduce a framework to study the tidal deformation of relativistic anisotropic compact stars. Anisotropic stresses are ubiquitous in nature and widely used in modelling compact stellar objects. Tidal deformability of astrophysical compact objects is a natural effect of gravity, such as one produced by a companion in a binary system. In general relativity, the existence of this measurable effect of gravity can be quantified by their tidal Love numbers (TLN), which characterize the deformability of a neutron star (NS) from sphericity. The tidal deformability or polarizability parameter of an NS depends on its complex internal structure, and hence, the nature of the compact object can be studied by measuring the TLN. We choose a particular solution, which is the anisotropic generalization of the Tolman IV model, as the interior of the compact stellar object. The physical acceptability of the

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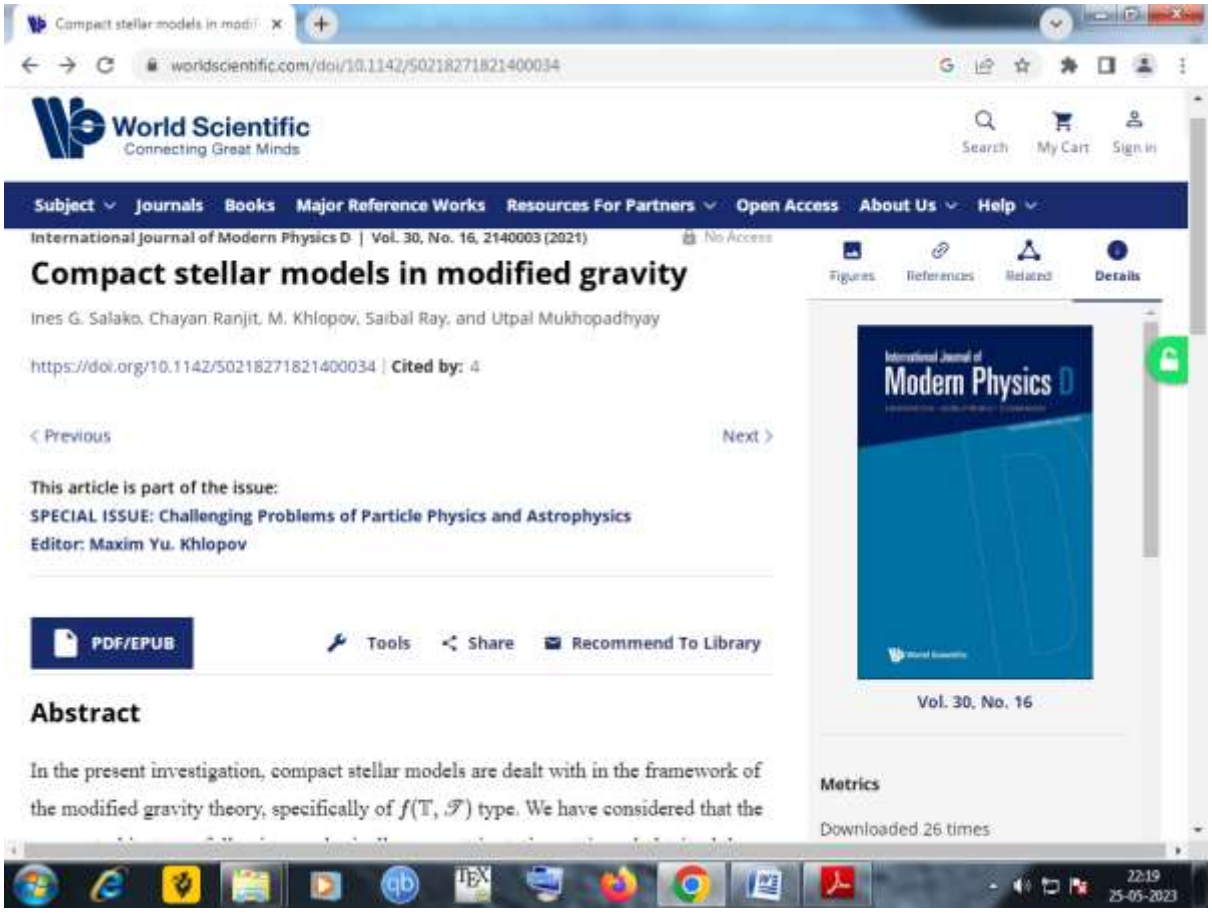
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In the present investigation, compact stellar models are dealt with in the framework of the modified gravity theory, specifically of $f(T, \mathcal{T})$ type. We have considered that the
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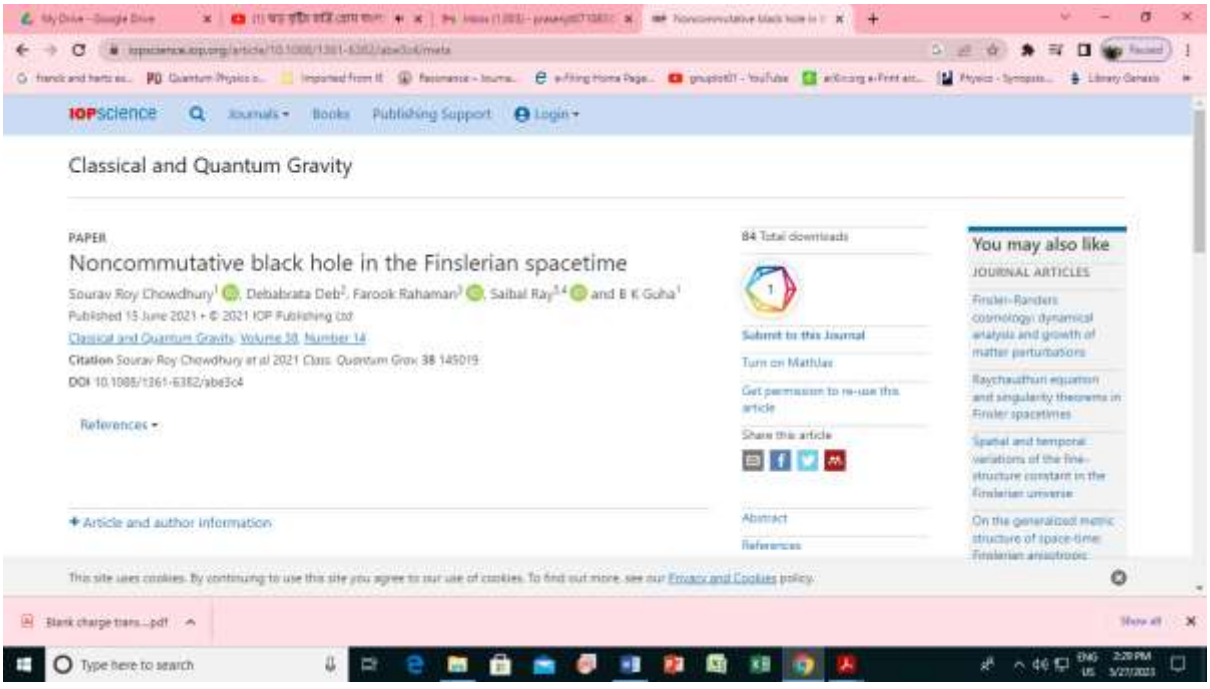
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In developed countries, the average daily variation in hourly demand for electric power is about 40% of the peak demand. To meet the variation in hourly demand, the steam power plants must vary the generation using cycling operation. Many large countries such as USA, Russia, and European Union use multiple time zones in their territory to match their standard time with the daylight hours. However, these time zones do not focus on reducing the cycling operation of steam power plants. This model proposes the use of a precise algorithm in setting up multiple time zones in a territory to reduce the cycling operation of steam power plants. It recommends setting up multiple time zones in any geographic territory across the globe with an integrated power grid where the longitude difference between the Far East and Far West is more than an hour of solar time. It has been demonstrated by applying this model that the
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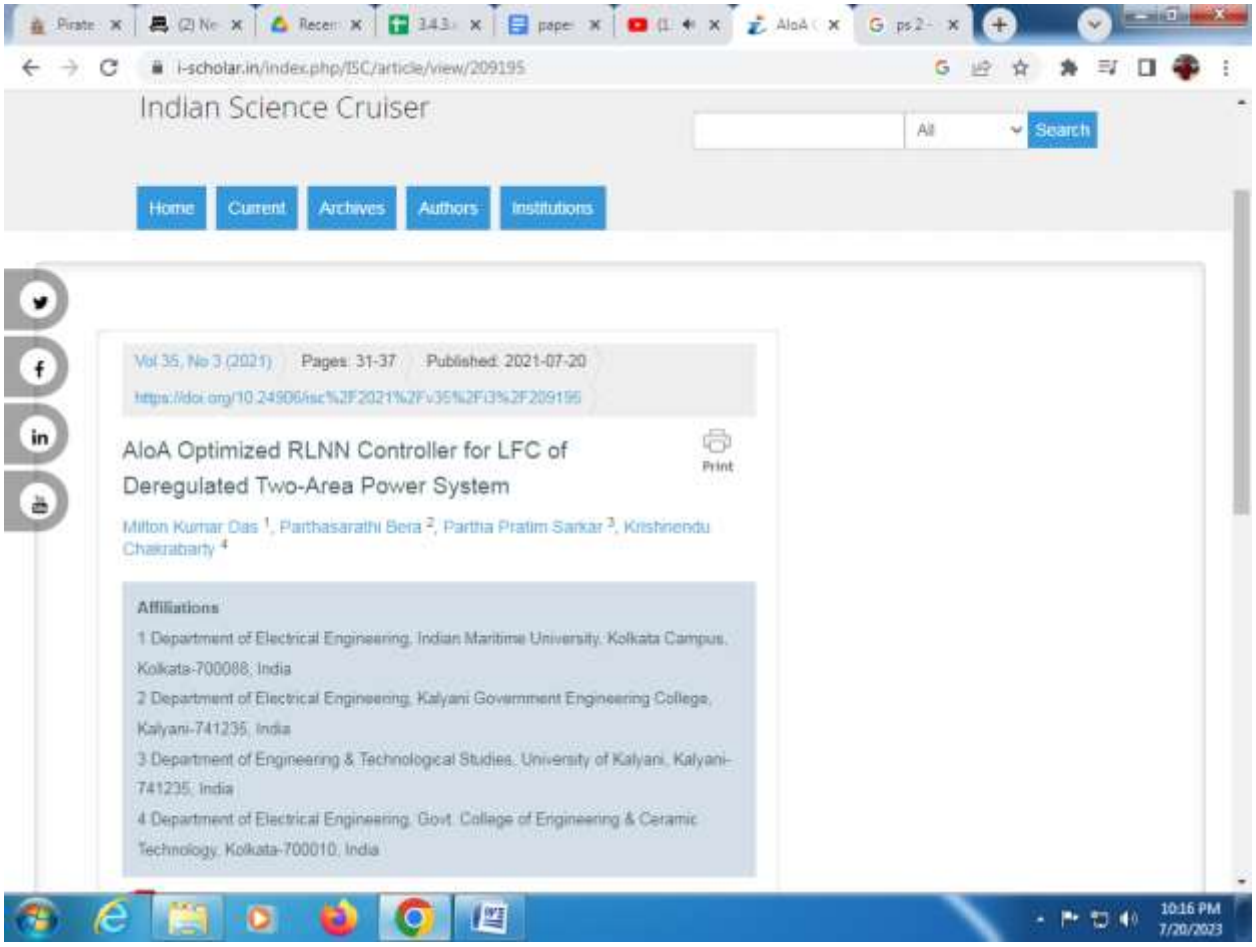

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AIoA Optimized RLNN Controller for LFC of Deregulated Two-Area Power System

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Milton Kumar Das [1], Parthasarathi Bera [2], Partha Pratim Sarkar [3], Krishnendu Chakrabarty [4]

Affiliations

1 Department of Electrical Engineering, Indian Maritime University, Kolkata Campus, Kolkata-700088, India

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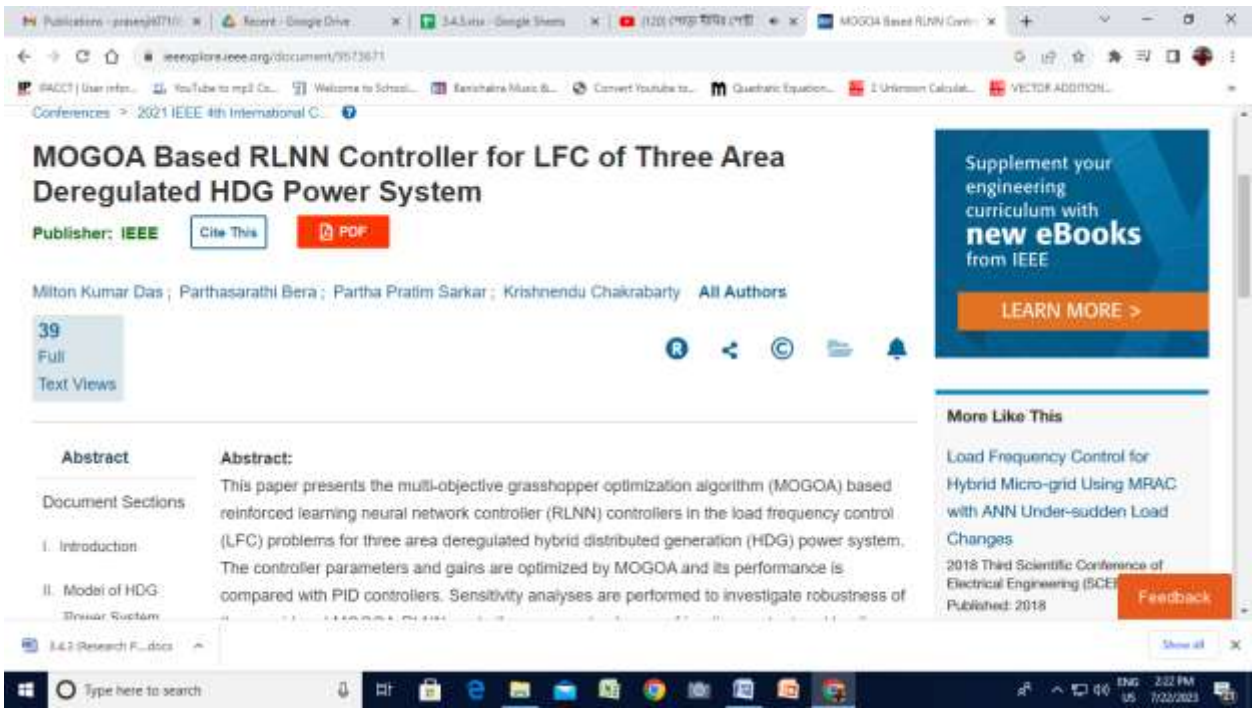

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MOGOA Based RLNN Controller for LFC of Three Area Deregulated HDG Power System

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Abstract

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Abstract:

This paper presents the multi-objective grasshopper optimization algorithm (MOGOA) based reinforced learning neural network controller (RLNN) controllers in the load frequency control (LFC) problems for three area deregulated hybrid distributed generation (HDG) power system. The controller parameters and gains are optimized by MOGOA and its performance is compared with PID controllers. Sensitivity analyses are performed to investigate robustness of

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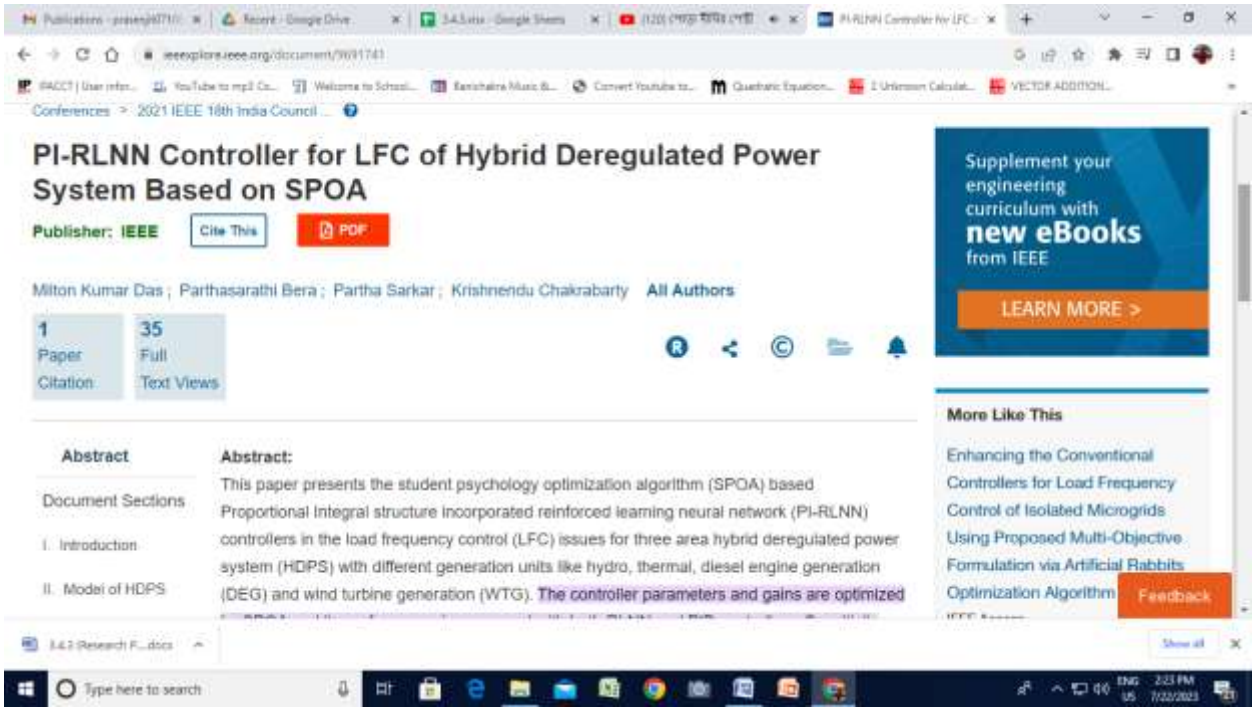
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DOI: 10.1111/ijac.13716

ORIGINAL ARTICLE

Applied Ceramic Technology

A novel approach toward microstructure evaluation of sintered ceramic materials through image processing techniques

Sandipan Chowdhury[1] | Dipika Dhara[2] | Soumit Chowdhury[3] | Partha Haldar[4] | Kingshuk Chatterjee[3] | Tapas Kumar Bhattacharya[1]

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Email: tkb_ceramics@yahoo.co.in

Funding information
Department of Science and Technology and Biotechnology, Govt. of West Bengal, Grant/Award Number: 10 (Sanc.)-ST/P/S&T/6G-4/2018

Abstract

In this paper, an image processing technique is introduced to measure the grain size and their distributions from the SEM image of copper oxide (CuO) and titanium dioxide (TiO_2) doped sintered alumina ceramics accurately. The noise present in SEM image is removed by applying low pass Gaussian filter followed by suppression of regional minima over a threshold. The clarity of individual grains and grain boundaries have been done by applying Watershed transform to this preprocessed SEM image. Morphological operations like dilation and erosion are used to make the grain-boundary edges clear and continuous. The individual grain size in μm scale is measured from the pixel length of the rectangular bounding box drawn around the segmented grain. The normal Gaussian type distribution of grain size is observed in both CuO- and TiO_2-doped grains in SEM image. The average grain size of CuO-doped alumina grains (2.24 μm) is very close to G_{50} value (2.17 μm), but G_{50} value of TiO_2-doped grains (8.59 μm) is slightly higher than its average grain size (7.96 μm). The proposed algorithm is compared with linear intercept method and the grain sizes obtained are very close to each other.

KEYWORDS

alumina, doping, grain size, image processing, scanning electron microscopy

1 | INTRODUCTION

The present research in material science and engineering are inclined toward interdisciplinary areas and in these aspect different tools of computer science plays an essential role to evaluate and explain the material properties more accurately. Therefore, emerging research work focuses to frame an accurate and automated feature analysis of the properties of engineering materials.[1] Scanning electron microscopic (SEM) image is the acquisition of useful signal produced by the interactions between electron beams and surface electrons of the specimen. SEM image consists of grains of different phases, grain morphology, surface texture, pores, and inclusion in the microstructure.[2] The single oxide polycrystalline ceramics generally shows grain growth in an irregular manner. The dopant materials inhibit this abnormal grain growth which is characterized by nontextured grains of tetrakaidecahedral shape having log-normal size distribution. The average grain size is based on near to spherical geometry with not so much wide size distribution.[3,4] These can be studied in-depth with the help of digital image processing technology.[5-7] The properties of engineering materials are related to the variation in grain size, size distribution, and pores present in the microstructure. The microstructures are also controlled by different process parameters like sintering temperature, soaking time, the effect of foreign inclusion, nature and concentration of doping, etc.[8,9] In this context the microstructure related studies based on different computing techniques such as fuzzy logic, neural network, and statistical image analysis should be highlighted. Dutta et al.[10] have studied tensile fractography of AISI 3041.N austenitic stainless steel to detect and characterize

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ORIGINAL CONTRIBUTION

Artificial Neural Network based Dimension Prediction of Rectangular Microstrip Antenna

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Abstract A computational method for the prediction of dimensions of a microstrip antenna has been proposed in this work. The model uses artificial neural network (ANN) as the chief designing tool for the development of the predictor model. The ANN structure has been designed to take three major output parameters as input, viz. resonant frequency, fractional bandwidth and return loss. The outputs of the model are assigned as the three major design parameters of the antenna model: length, width and position of feed point. Equal number of input and output parameters of the model enhances the importance of the model. Backpropagation topology has been adopted while designing the ANN structure. Validation of the proposed ANN model is carried out by designing and simulating the prototype antenna models using the predicted dimensions in IE3D software. The proposed model yields an average error of 1.014% in predicting resonant frequency using the designed antenna with the model-predicted design parameters. Similarly, the average error is found to be 2.38% in case of bandwidth, both of which validates the effectiveness of the predictor model.

Keywords Microstrip patch antenna (MPA) · Artificial neural network (ANN) · Resonant frequency · Bandwidth · Return loss

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Introduction

Microstrip patch antenna (MPA) is a popular name in the field of antenna technology, especially due to the numerous advantages, it offers like light weight, compact as well as flexible structure and design, etc. although it suffers from its major drawback of narrow bandwidth. Hence, microstrip and printed antennas have a wide range of applicability, especially in fields like Global Positioning System (GPS), Bluetooth automotive applications with RHCP, Satellite Digital Audio Radio Services (SDARS) and so on. Designing highly accurate antennas for a particular application in different fields is a great challenge for the engineers. These antennas are characterized by a large number of physical parameters compared to the conventional microwave antennas, thus enhancing the design complicacy as well as delicacy to a higher level.

The objective of the proposed work is to develop a neural network-based predictor model to predict the dimensions of a prototype microstrip antenna, like length and width, as well as the feed position for a specified set of desired parameters like resonant frequency, 2:1 voltage standing wave ratio (VSWR) bandwidth and return loss. The present work applies artificial neural network (ANN) for the design of the desired MPA model. The effectiveness of the model lies in the fact that the proposed design is intended to predict all the three major geometric parameters of the antenna model, using only three primary input parameters as mentioned. Most of the works in the literature concentrate majorly on the accurate prediction resonant frequency and bandwidth of the design. Apart from these two major parameters, this present work pays emphasis on the return loss component as well while developing the model, which is highly related to antenna matching. As per the design parameters are concerned,

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Engineering of the structural and morphological characteristics of MWCNTs employing a nano-dimensional binary oxide coating with enhanced thermal oxidation resistance properties for the tailoring of their reinforcement potential†
Paromita Das, ‡ Savan Kumar Sharma and Barun K. Sanfui *
The present investigation demonstrates the rational design of a novel nano-hybrid architecture deploying the stable hybridization of inorganic MgAl-binary oxide nanoparticles with multiwalled carbon nanotube (MWCNT) structures via a strategic and realistic processing scheme, which in turn resulted in distinguishable core–shell morphological features. Herein, the critical alteration of the surface chemistry of the carbonaceous network and the variable incremental alteration of the oxide loading concentration act as key controllable factors promoting the conformal deposition and stable assembly of an inorganic binary oxide shell network at an interfacial position, with a consequent enhancement of the thermal stability of the nano-hybrid architecture. The detailed structural evolution of the core–shell nano-hybrid structure and its key characteristic features have been verified in detail via TG-DTA, FTIR, XRD, Raman, SEM, TEM/SAED, and XPS analysis. It has been observed that thermal treatment at a suitable temperature readily induces a stable passivation layer of inorganic MgAl-binary oxide thin film with a thickness of ~30 nm, which strongly assists the structural reorganization of the core MWCNTs in a positive way, thereby strongly preserving the shape, purity, and structural integrity of the inner CNTs under harsh environmental conditions. Finally, the present investigation provides a detailed mechanistic view unveiling the structure–property relationship, explaining the thermal oxidation stability and exploring the reinforcement potential of the nano-hybrid structure on the macroscale.
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Fabrication, characterization and optimization of industrial alpha alumina powders based ceramic membrane supports and its applicative potential for CO_2/N_2 separation

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Keywords:
Industrial grade alpha alumina support
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ABSTRACT

In this investigation, an economically feasible strategy has been proposed for the fabrication of good quality membrane support by utilizing low-cost industrial-grade alumina powders, coded as A-16SG and CT-1200SG with an average particle size of 0.44 and 1.41 μm, respectively. Herein, the meticulous alteration of the processing parameters and the targeted utilization of industrial grade powders with distinctive particle morphologies have shown promising aspect towards governing the overall sintering and densification behavior, pore morphology and the microstructural facets of the sintered alumina compacts. More precisely, while connecting the structure-property relationship aspect, the broader particle size distribution and the higher quartile ratio of CT-1200SG powders lends to originate relatively higher average pore size and wider pore size distribution in the as-optimized sintered membrane support system in comparison to the narrow particle sized and low quartile ratio comprising A-16SG powder. Additionally, the near surface morphology of the intermediate layers deposited over the two distinctive membrane support systems via implementing differential colloidal chemistry of the respective sols have also been demonstrated for the precise understanding of the role of particle morphology on the progressive perseverance of pore characteristics of the overall asymmetric graded membrane substrate. Finally, the performance evaluation of the alumino-silicate membrane layer assembled on the tailor-made multilayered graded cost-competent alumina support system has been executed which revealed comparable

Innovative Approach to Evaluate the Wearing of Nano-TiO_2-Doped Alumina Ceramics in the Light of Image Modeling

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The present research is emphasized on the microscopic observation of post-wear surface of nano-TiO_2-doped alumina ceramics to access wearing by promising image processing algorithms, namely, entropy analysis, Sobel edge detection technique, and entropy filtered image histogram analysis in relation to the extent of doping. The experimental results of specific wear-rate showed an indicator with the extent of microfracturing of grains, plowing of materials and debris formation on the wear track after a long wear cycle in terms of entropy level, edge density index, and entropy filtered image, and the nature of histogram at different doping levels. The lowest value of entropy level and edge density index is shown at the level of 1 wt%. TiO_2-doped alumina ceramics due to the presence of low number of granularity and microfracture grains on the wear track cause the lowering of specific wear-rate. The histogram of entropy filtered image for 1 wt% doping is more uniformly distributed with the highest frequency and lowest skewness factor over a wide range of intensity values.
[DOI: 10.1115/1.4051904]

Keywords: dry friction, wear, alumina-titania ceramics, image processing, edge detection, entropy analysis

1 Introduction

Wear is an important tribo-mechanical property of materials related to the progressive loss of material from the solid surface by mechanical interaction of two sliding surfaces under load [1]. Therefore, knowledge of wear-rate is of technical importance for accessing the life of the materials. Wear can quantitatively be measured by a mass loss method, dimensional change method, volume loss method in relation to testing parameter, contact geometries and environmental condition, etc. [2]. The incorporation of nano-additives in alumina ceramics improved wear resistance by modifying microstructure, inhibiting abnormal grain growth, and controlling the volume fraction and size distribution of nano-particles in reinforcing matrix [3]. The importance of alumina lies heavily in bio-ceramic owing to its properties like excellent corrosion resistance, good biocompatibility, low friction, high wear resistance, and high strength [4], which are indispensable properties for prosthesis technology. It is further observed that the addition of titania as a sintering aid in alumina sample improves the tribo-mechanical properties of the ceramic [5–7].

The present research scenario in material science and engineering are inclined towards interdisciplinary areas by adopting soft computing to explain the properties of engineering materials more accurately. Therefore, emerging research work should be framed to understand the properties of engineering materials more accurately by applying the algorithm of soft computing in an automated manner [8,9]. The scanning electron microscopic (SEM) image is a digital domain of two-dimensional (2D) intensity map. Each pixel of SEM image corresponds to the captured signal intensity at every point. Prolong action of mechanical stress on the surface of the specimen results in microfracturing, axial crack formation, and plowing of materials and debris formation. The morphological features of the worn-out surface are to accumulate the induced signals, and image processing techniques have been implemented to judge the specific wear-rate using different deterministic parameters of the image analysis methods [10]. Application of various image processing methods is found widely in the literature in various fields like remote sensing [11], medical field [12], encoding system [13], machine vision [14], color processing [15], pattern recognition [16], etc. Alurki et al. [17] measured the cavitation erosion on stainless steel surface by 2D discrete wavelet packet transform in terms of mean depth penetration (MDP). The result showed that MDP values were inversely proportional with corrosion in contact with the oil–water emulsion. The application of image processing techniques is in use in cutting tool wear prediction for a long time. Jurkovic et al. [18] have developed a flexible system that can measure tool wear with high spatial resolution and good accuracy. They have performed the digitization of the image followed by image analysis and finally evaluated a set of tool wear parameters. They used a vision system to measure tool wear using a charge-coupled device camera and laser diode with a linear projector. Wang et al. [19] measured flank wear in milling by analyzing successive images captured by a high-speed camera in a periodic manner without stopping the spindle. The successive operation-like edge detection by applying Sobel operator, edge enhancement, thresholding, edge line extraction, and morphological operation is used to obtain reference line of the image. Loizou et al. [20] developed an algorithm to monitor tool wear for a linear broaching based on the overall wear area. They automated the method with image cropping and digital image processing tools to determine the affected area without requiring any manual intervention. Thakre et al. [21] also developed an automatic calibrated system to monitor flank wear of carbide tool insert by a machine vision system by monitoring wear related parameters like average tool wear width, tool wear area, tool wear perimeter, etc. The vision system result of average tool wear lies within 3% error range with respect to the experimental results. Kerr et al. [22] also monitored tool wear of modern computer numerical control machine in real-time and established a good correlation with the expected wear characteristics. They showed that the extent of

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ORIGINAL CONTRIBUTION

Potential of Pumped Hydro Storage as an Electrical Energy Storage in India

Partha Haldar[1] · **Nipu Modak**[2]

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Abstract Congestion in power flow, voltage fluctuation occurs if electricity production and consumption are not balanced. Application of some electrical energy storage (EES) devices can control this problem. Pumped hydro-electricity storage (PHS), electro-chemical batteries, compressed air energy storage, flywheel, etc. are such EES. Considering the technical maturity level, storage time, capital cost, life cycle, potential etc., in India, PHS is found to be the best possible option with no additional fuel needs. In India, the Central Electricity Authority (CEA) has identified 63 sites where 96,524 MW PHS can be installed but at present 9 PHS with a total installed capacity of 4785.6 MW are in operation and 1205 MW is under construction [February 2021, CEA]. Therefore, India has wide scope to enhance its hydropower generation along with PHS. Generally, the lifespan of a PHS project is at least 50 years and these hydro projects help in reducing carbon footprint of Indian power sector as well as conserving scarce fossil fuels. So, in this paper, all the technical views related to PHS are discussed along with total PHS scenario of India as well as the constraints and policies are summarized.

Keywords Electrical energy storage (EES) · Pumped hydroelectricity storage (PHS) · Hydropower of India

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Introduction

The demand of electrical energy varies between day and night, week days and holidays, daily and weekly [1]. To meet this demand, base load power plants like thermal and nuclear power stations are providing continuous supply [2]. But to crater the peak load demand for a few hours of a day, in India, the generating units maintain large production capacity. This practice in turn results in uneconomical, inefficient, oversized, non-environmental power system and hence the generating companies earn less revenue. But if electrical energy storages (EES) are considered as the part of power system, as shown in Fig. 1, the generation capacity should meet only the average electrical demand and thus system efficiency improves. EES is a methodology by which electrical energy from the grid can be stored into a suitable form, and it can be restored back into electrical energy as per requirement [3]. This methodology provides opportunity to store excess energy of grid at the times of lower demand, lower generation cost or from intermittent energy sources and the stored energy can be utilized at the times of higher demand, higher generation cost [4]. It is well known that the conventional electricity generation has no storage facility and as a result the supply should be controlled in such a way that it matches the demand [5]. This type of controlled generation is quite difficult for the renewable energy generating systems since the sources like solar, wind, etc. are intermittent in nature. Therefore, EES systems are urgently needed to be tie up with renewable energy generating systems [6]. On the other hand, India has already started utilizing its renewable energy potential and as on 28.02.2021, the renewable energy capacity (excluding large hydro) of India has reached 92,970.48 MW. Wind provides 41.72% of renewable power, while 42.04% is provided by solar

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REVIEW

Cupola slag reutilization for sustainable waste management: review and economic analysis

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Received: 2 March 2021 / Revised: 8 June 2021 / Accepted: 20 July 2021

Abstract
Investigation of recycling and reutilizing capability of industrial wastes is essential to attend the vision of sustainable waste management. One such industrial waste is cupola slag, a by-product of grey cast iron. This slag mainly ends up in dump yards or landfills due to a lack of proper attention. This article aims to analyse available previous literature to understand every possible door for reutilizing cupola slag to attain the goal of sustainable waste management. Primary importance is given to the utilization of cupola slag in the building industry as partial or full substitution of fine and course natural aggregates as well as cement for making concrete. The reusability has been analysed by extensive investigations on microstructure, chemical and physical properties of cupola slag starting from its origin. Very few analyses of the utilization of cupola slag can be found in different sectors such as for making glass ceramics, synthesizing zeolite and phosphorus-based fertilizers, making ceramic foams, road construction and use as artificial pozzolan. The extensive analysis not only opened a huge opportunity to ensure reuse of industrial waste, i.e. cupola slag but also utilization can provide some added advantages of being eco-friendly. A sustainable future can be assured by more rigorous study and implementation of methods for the reuse of cupola slag.

Keywords Waste recycle · Cupola slag reuse · Green concrete · Pozzolan

Introduction

The term sustainable application in any process is described as the system of improvement which meets the demand of the present without affecting the future generation's ability to fulfil their demands (Silvestre and Ţîrcă 2019). The rapid growth of industrialization to meet the demand of exponential population growth leads to a large amount of industrial waste. These industrial wastes are extremely toxic to the environment, thus should be properly decomposed, reused or recycled for reaching the goal of a cleaner environment.

Cast iron is a very potent material that has numerous applications such as in machine tool beds, automobile components, valve bodies, soil pipe, shipbuilding, manhole cover, and sanitary castings, etc. (Berns and Theisen 2008). Cast iron is produced in cupola by melting pig iron, scrap, coke and limestone together in a proper ratio termed as the charge (Hansson 1989). This melting process has output of molten grey cast iron (of different grades and alloys) along with by-products, i.e. slag. The data from the latest census (2014) indicate that there are about 47,145 casting plants worldwide, among them 21,532 (45.7%) are cast iron plants. A total sum of 47.795 million tonnes of cast iron is produced in these cast iron plants per annum (Soiński et al. 2016). Global cast iron production increased by 2.4 million tonnes in 2013 to 2014. India is producing 10% of the global production which is about 11 million tonnes of castings per annum; 68% of total castings produced in India are cast iron. There are about 5000 cupolas that are producing about 7.5–8 million tonnes of castings in India. Normally 5–6% slag is produced in every run and it is highly dependent on the foundry location, melting technology, properties of charge and many other factors of the foundry so, it varies from foundry to foundry (Beeley 2001). This results in

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REVIEW

Scope for cupola slag reuse in construction: a sustainable green solution

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Received: 4 August 2021 / Revised: 19 January 2022 / Accepted: 24 April 2022

Abstract

Impact of different industrial wastes in environment is a major threat nowadays. One such industrial waste, cupola slag, a by-product of cast iron production in cupola furnace has no commercial utilization due to lack of proper waste management practices. Thus, it segregates into landfills causing a major damage to environment. Research indicates that cupola slag exhibits good hydraulicity and pozzolanic properties when compared with conventional building materials. This opens a door to reuse cupola slag in making cement concrete. The major constituents of cement concrete namely cement, fine and coarse aggregates can be partially or completely substituted by cupola slag to develop green concrete. This work presents a critical review of past studies on development of green concrete using cupola slag as a substitute for conventional building materials. The cost of producing such novel green concrete has also been compared with conventional controlled concrete mix which followed by detailed analysis of limitation and approaches to overcome them. This work will be beneficial to the foundry owners and researchers working in this field.

Keywords Green concrete · Cupola slag · Solid waste management · Environmental pollution

Introduction

The cupola is used to melt pig iron and fluxes for producing grey cast iron. A secondary product is produced in this system is referred as cupola slag. 40–80 kg slag is produced per ton of cast iron manufacturing (Pribulova et al. 2019). Cupola slag seems as a stony and amorphous material. It is a fused product that contains oxidized impurities of metals and silicon oxide (Aderibigbe and Ojobo 1982). Melting technology in cupola along with constituent of input charge influences chemical composition of cupola slag. Cupola slag consists of Al_2O_3, MnO, SiO_2, MgO, TiO_2, CaO, Fe_2O_3, Cr_2O_3, Na_2O_3 as mentioned by various academician (Aderibigbe and Ojobo 1982; Stroup et al. 2003; Balaraman and Ligoria 2015; Mistry et al. 2016; Ladomerský et al. 2016; Patel et al. 2016; Pribulová et al. 2018; Varkey 2018; Pribulova et al. 2019). Rate of crystallization and slag viscosity while cooling directly depends on chemical composition of the slag. Thus, the porosity, dimension and properties of solid slag depend on chemical composition. Possible use of slag can essentially be affected by this fact (Baricova et al. 2018). There are 47,145 cast iron plants existing all over the world amongst them 21,532 are using cupola for melting. The amount of cast iron production is 47.795 million tons per year worldwide. India alone produces 11 million tons of cast iron every year. There are 5000 cupola furnaces in

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EXPERIMENTAL INVESTIGATION AND OPTIMIZATION OF MRR IN μ-ECDM PROCESS BY TAGUCHI, RSM, PSO AND ANN

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Received: May 22, 2021; Revised: July 24, 2021; Accepted: September 30, 2021

Abstract

Electrochemical Discharge Machining process applied for machining of both electrically conducting and non-conducting materials. It became crucial to measure the material removal rate while processing of advanced materials. This paper deals with comparison of optimization of MRR by different techniques like Taguchi method, RSM, PSO and ANN during μ-profile generation on glass material using μ-ECDM process. The experiments were conducted using the combinations of three input parameters such as voltage, electrolyte concentration and pulse frequency based on different experimental design. Increase in voltage and electrolyte concentration results in MRR increase, but with increase in pulse frequency MRR decreases. Optimal value of MRR along with the parametric combinations using all four techniques has been derived and compared.

Keywords: MRR; μ-ECDM, Taguchi L9 array, ANOVA, PSO; ANN; RSM

Introduction

The quality of life of all human beings continues to increase day by day with the invention of new products and components which are developed by different manufacturing methods. Machining is one of the most important manufacturing processes by which different products can be produced with dimensional accuracy in the range of millimeter to nanometer. Conventional machining processes are mainly turning, milling drilling which are performed in machine tools such as lathe, shaper, milling machine and drilling machine etc. These techniques are mainly used for higher material removal rate and large dimension objects. The parts produced by conventional machining are robust. Machining of sophisticated and advanced materials with complex and intricate shape is almost impossible with existing conventional processes (Grzesik, 2016). Thus, several non-conventional machining such as ultrasonic machining (USM), electrochemical machining (ECM), electric discharge machining (EDM), abrasive jet machining (AJM) etc. have developed over the years (Khandekar and Chakraborty, 2016). The demand of advanced engineering material and precise manufacturing of near net shape product cannot be achieved alone by non-traditional machining, so further extension have been proposed in the form of hybrid machining (Shrivastava and Dubey, 2014).

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Tribological Behavior of Alumina Ceramics With Nano-TiO_2 as a Sintering Aid in Non-Conformal Contact

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The study emphasized the sintering behavior and tribo-mechanical properties of alumina ceramics by nano-TiO_2 addition as a sintering aid. With increase in sintering temperature, the bulk density of alumina has increased gradually and optimized at 1600 °C. The optimizing effect of densification at 1600 °C is 98.25% by the addition of 1 wt% nano-TiO_2. The maximum solid solubility of titania in alumina grains was at 1600 °C and causes optimization of densification by addition of 1 wt%. The excess addition of TiO_2 formed low dense Al_2TiO_5, appearing as a secondary phase at grain boundaries and does not significantly improve densification. Fracture toughness increases and coefficient of friction decreases with the addition of nano-TiO_2 in alumina matrix. The addition of 1 wt% nano-TiO_2 improved hardness to 8.82% and reduces specific wear-rate to 45.56%. The addition of 1 wt% nano-TiO_2 greatly influenced the microstructure of sintered Al_2O_3. The morphology was sharply changed from hexagonal columnar shape to order sub round orientation which also directly impact the tribo-mechanical properties of sintered alumina. The addition of 1 wt% substantially decreases wear track depth as observed by a 3D surface profilometer. Microscopic observation of the worn-out surface showed that wearing is majorly caused by plastic deformation and abrasion. [DOI: 10.1115/1.4053128]

Keywords: sintering, mechanical properties, wear resistance, alumina ceramics, dry friction, surface properties and characterization, wear mechanisms

1 Introduction

Alumina ceramics is a prevalent material and finds numerous applications owing to its outstanding properties like low density, high hardness, high stiffness, thermal and chemical inertness, wear and corrosion resistance, and ease of processing even at elevated temperature [1–4]. Alumina ceramic has potential applications in various engineering fields like lining for pipes, vessels, pumps, etc., cutting tools, laser tubes, high temperature electrical insulators, grinding media, wear pads, components of bearings, electronic components, aircraft brakes, aerospace, automobiles, defence especially in un-lubricated engines, and even in biomedical [5–10]. However, alumina possesses relatively low fracture toughness and as a result, the material becomes brittle which in turn limits the application of alumina. The basic differences between conformal and non-conformal type contact lie on the area of contact between the tribo-pair. Conformal contact implies that the mating surfaces have higher geometrical conformity during cylindrical pin-on-disc tribotest [11]. On the other side, the mating pairs are considered as non-conformal contact if they have very less conformity in terms of their contact area like ball on disk tribotest. In this case, the area of contact is less and therefore, a small amount of normal load can generate huge amount of pressure on the surface. Plenty of research has been carried out regarding enhancement of tribological behavior as well as fracture toughness in conformal contact with the addition of different oxides like MgO, CuO, TiO_2, ZrO_2, Y_2O_3, Nb_2O_3 [12–18], and non-oxides like TiC, SiC, TiN, TiB_2, CaF_2, carbon nano-tube (CNT) [19–23], etc. as a secondary phase in alumina matrix. But a similar study for non-conformal contact is hardly found. It is also well known that friction is a system response. Counter surface is vital in determining coefficient of friction (COF) as reported by Kerkwijk et al. [14]. It was also reported in this context that COF increased from 0.55 to 0.70 when Al_2O_3 ball is substituted by Yttria-stabilized Tetragonal Zirconia Polycrystal ceramics (Y-TZP) ball as a counter surface on sintered alumina. Moreover, it was reported that other factors like sintering temperature, environment, and microstructure have major influence on the tribo-mechanical properties of CuO added 3Y-TZP ceramic system sliding on Al_2O_3 [24,25].

Winkler et al. [26] reported that the solubility limit of titanium dioxide in alumina is up to 0.27 wt% for samples fired in air in the temperature range from 1300 to 1700 °C. They also found that titanium in doped samples of alumina is present as both Ti^{3+} and Ti^{4+} in samples fired in air. The aluminum titanate (Al_2TiO_5) phase is formed when the amount of TiO_2 goes above the solubility limit and temperature is also above 1280 °C. The Al_2TiO_5 phase formation is due to the transport of Al^{3+} through the TiO_2 layer followed by reaction with TiO_2. The high diffusivity of Al^{3+} in TiO_2 might be responsible for the formation of Al_2TiO_5 phase [27]. The second phase, Al_2TiO_5 in alumina ceramics, can enhance fracture toughness [28–30]. Lee et al. [7] showed that inclusion of nano-meter-sized particles of TiO_2 in alumina causes enhancement in fracture toughness and wear resistance. Wang et al. [31] fabricated in situ alumina/aluminum titanate ceramics using spark plasma sintering with micro and nano-sized powders. They showed that the dominating wear mechanism involved for the nano-composites was intergranular fracture and grain pull-out; whereas for the micro composites, plastic deformation was observed due to the formation of a surface reaction layer.

The present work is intended towards the substantial betterment of different tribo-mechanical properties like fracture toughness,

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Artificial Intelligence in Brain Informatics

MRI-based brain tumour image detection using CNN based deep learning method

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ABSTRACT

Introduction: In modern days, checking the huge number of MRI (magnetic resonance imaging) images and finding a brain tumour manually by a human is a very tedious and inaccurate task. It can affect the proper medical treatment of the patient. Again, it can be a hugely time-consuming task as it involves a huge number of image datasets. There is a good similarity between normal tissue and brain tumour cells in appearance, so segmentation of tumour regions become a difficult task to do. So there is an essentiality for a highly accurate automatic tumour detection method.

Method: In this paper, we proposed an algorithm to segment brain tumours from 2D Magnetic Resonance brain Images (MRI) by a convolutional neural network which is followed by traditional classifiers and deep learning methods. We have taken various MRI images with diverse Tumour sizes, locations, shapes, and different image intensities to train the model well. Furthermore, we have applied SVM classifier and other activation algorithms (softmax, RMSProp, sigmoid, etc) to cross-check our work. We implement our proposed method using "TensorFlow" and "Keras" in "Python" as it is an efficient programming language to perform fast work.

Result: In our work, CNN gained an accuracy of 99.74%, which is better than the state of the result obtained so far.

Conclusion: Our CNN based model will help the doctors to detect brain tumours in MRI images accurately, so that the speed in treatment will increase a lot.

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Solving Travelling Salesman Problem using Artificial Immune System Optimization (AISO)

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Abstract: **Travelling Salesman Problem (TSP) is a typical NP complete combinatorial optimization problem with various applications. In this paper, a nature inspired meta-heuristic optimization algorithm named as Artificial Immune System Optimization (AISO) algorithm is proposed for solving TSP. There are other approaches for solving this problem, namely Greedy Method, Brunch and Bound (B&B), and Dynamic Programming (DP) but they are not very efficient. The time complexity of Greedy approach is $O(n^2)$. However, the Greedy method doesn't always converge to an optimum solution whereas the B&B increases search space exponentially and DP finds out optimal solution in $O(n^2 2^n)$ time. The population based meta-heuristic optimization algorithms such as Artificial Immune System Optimization (AISO) and Genetic Algorithm (GA) provide a way to find solution of the TSP in linear time complexity. The proposed algorithm finds out the best cell (optimum solution) using a Survivor Selection (SS) operator which reduces the search space to ensure that effective information is not lost. Dataset, results and convergence graphs are presented and accuracy of the analysis is briefly discussed.**

Index Terms: **Artificial Immune System Optimization (AISO), Dynamic programming (DP), Genetic Algorithm (GA), SS Operator, Traveling Salesman Problem (TSP).**

I. Introduction

The Travelling Salesman Problem (TSP) is a well known typical NP complete combinatorial optimization problem to find the minimum distance tour of a salesman who starts from his home city C_1 and covers all n cities exactly once and coming back to his home city C_1 (Schrijver,1960). TSP has numerous applications in computer wiring, vehicle routing (Lenstra & Rinnooy,1975), drilling problem of printed circuit boards (PCBs) (Grötschel et al., 1991), overhauling gas turbine engines (Plante et al., 1987) and X-Ray crystallography (Bland & Shallcross, 1989). TSPs are classified into symmetric TSP, asymmetric TSP, and multi TSP (Rajesh et al., 2010). Different approaches have been proposed to solve TSP, which can be classified into two categories: deterministic algorithms andmeta-heuristic algorithms.

Deterministic algorithms do not involve any randomness in the model. But it is a rigorous procedure. Greedy method (Sk. Mastan et al., 2019), Branch and bound algorithm (B&B) (Saad et al., 2013) and dynamic programming (R. Bellman, 1966), (V. B. Lobo et al., 1916) are the typical deterministic algorithms for solving TSP. Deterministic algorithms perform well on the TSP of small number of city tour. However, with the increase of the number of cities, greedy method does not produce optimal solution and the search space increases exponentially for B&B. The performance of deterministic algorithms degrade significantly. So, deterministic algorithms are not suitable for optimizing the TSP of large number of city tour.

Meta-heuristic optimization algorithm is a kind of stochastic algorithm which can accelerate the optimization process and find solutions in reasonable time but not guaranteeing to find the optimal solution.

Genetic Algorithm (GA) (J. McCall, 2005) and Ant Colony Optimization (ACO) (Dorigo& Gambardella, 1996; Dorigo & Gambardella, 1997) are some of the population based Meta-heuristic optimization algorithms which are successfully applied for solving TSP.

Artificial Immune System (AIS) is a population based meta-heuristic optimization algorithm which is inspired by structure, functions, models and information processing mechanism of biological immune system. Artificial Immune Systems and their applications are introduced by D. Dasgupta (Dasgupta, 1999).

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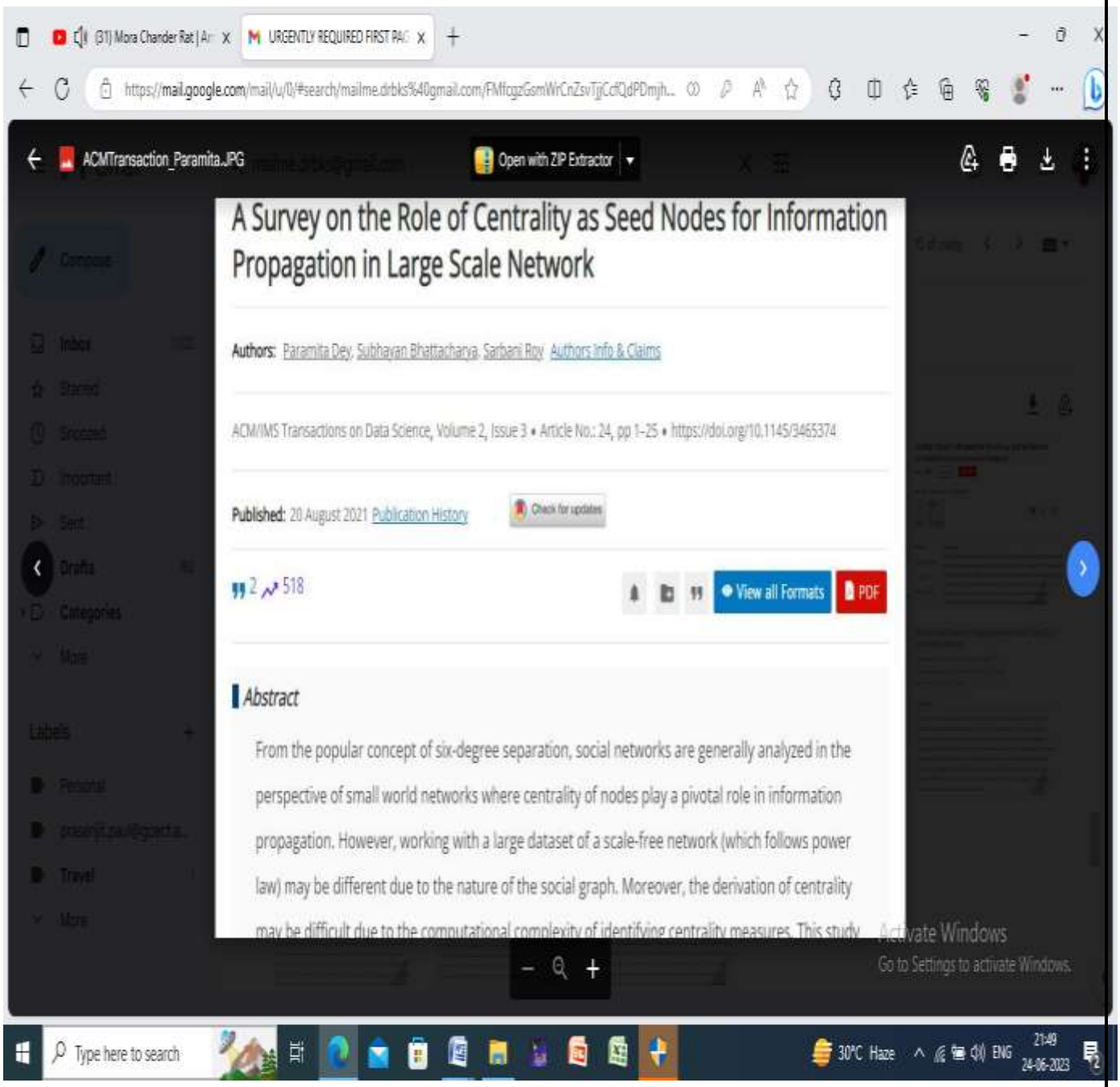
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A Survey on the Role of Centrality as Seed Nodes for Information Propagation in Large Scale Network
Authors: Paramita Dey, Subhayan Bhattacharya, Sarbani Roy Authors Info & Claims
ACM/IMS Transactions on Data Science, Volume 2, Issue 3 • Article No.: 24, pp 1–25 • https://doi.org/10.1145/3465374
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Abstract
From the popular concept of six-degree separation, social networks are generally analyzed in the perspective of small world networks where centrality of nodes play a pivotal role in information propagation. However, working with a large dataset of a scale-free network (which follows power law) may be different due to the nature of the social graph. Moreover, the derivation of centrality
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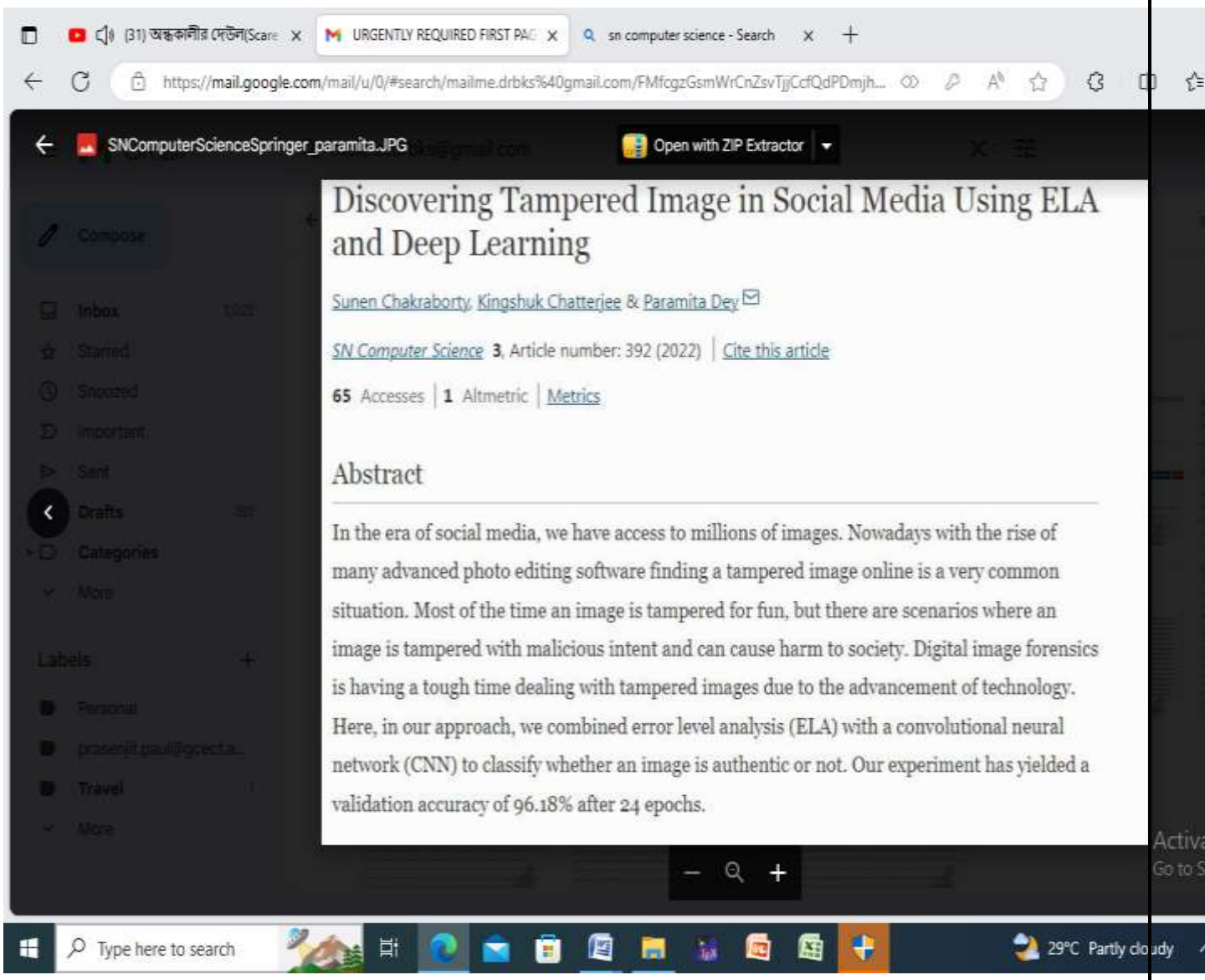
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Discovering Tampered Image in Social Media Using ELA and Deep Learning
Sunen Chakraborty, Kingshuk Chatterjee & Paramita Dey
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65 Accesses | 1 Altmetric | Metrics
Abstract
In the era of social media, we have access to millions of images. Nowadays with the rise of many advanced photo editing software finding a tampered image online is a very common situation. Most of the time an image is tampered for fun, but there are scenarios where an image is tampered with malicious intent and can cause harm to society. Digital image forensics is having a tough time dealing with tampered images due to the advancement of technology. Here, in our approach, we combined error level analysis (ELA) with a convolutional neural network (CNN) to classify whether an image is authentic or not. Our experiment has yielded a validation accuracy of 96.18% after 24 epochs.
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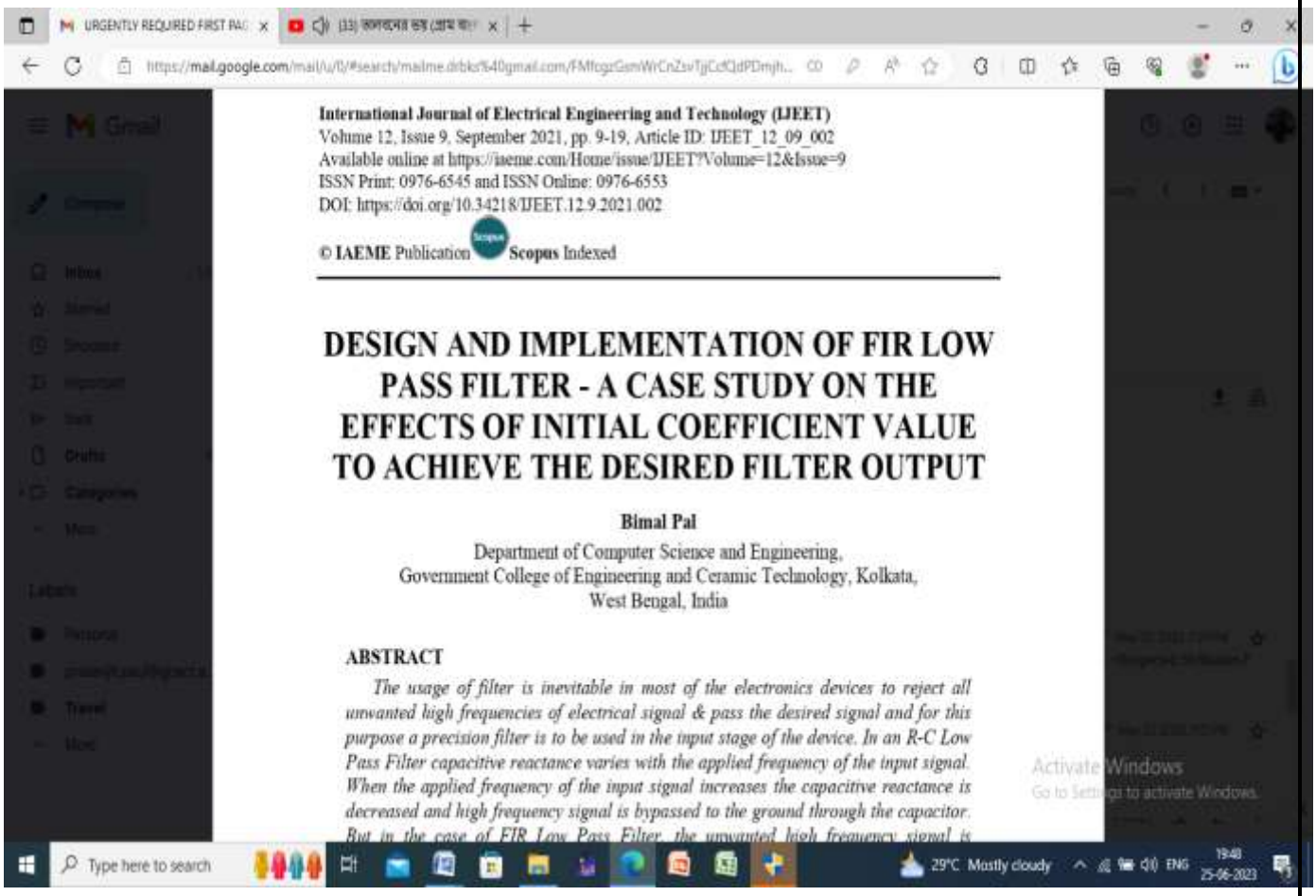

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DOI: https://doi.org/10.34218/IJEET.12.9.2021.002

DESIGN AND IMPLEMENTATION OF FIR LOW PASS FILTER - A CASE STUDY ON THE EFFECTS OF INITIAL COEFFICIENT VALUE TO ACHIEVE THE DESIRED FILTER OUTPUT

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ABSTRACT

The usage of filter is inevitable in most of the electronics devices to reject all unwanted high frequencies of electrical signal & pass the desired signal and for this purpose a precision filter is to be used in the input stage of the device. In an R-C Low Pass Filter capacitive reactance varies with the applied frequency of the input signal. When the applied frequency of the input signal increases the capacitive reactance is decreased and high frequency signal is bypassed to the ground through the capacitor. But in the case of FIR Low Pass Filter, the unwanted high frequency signal is

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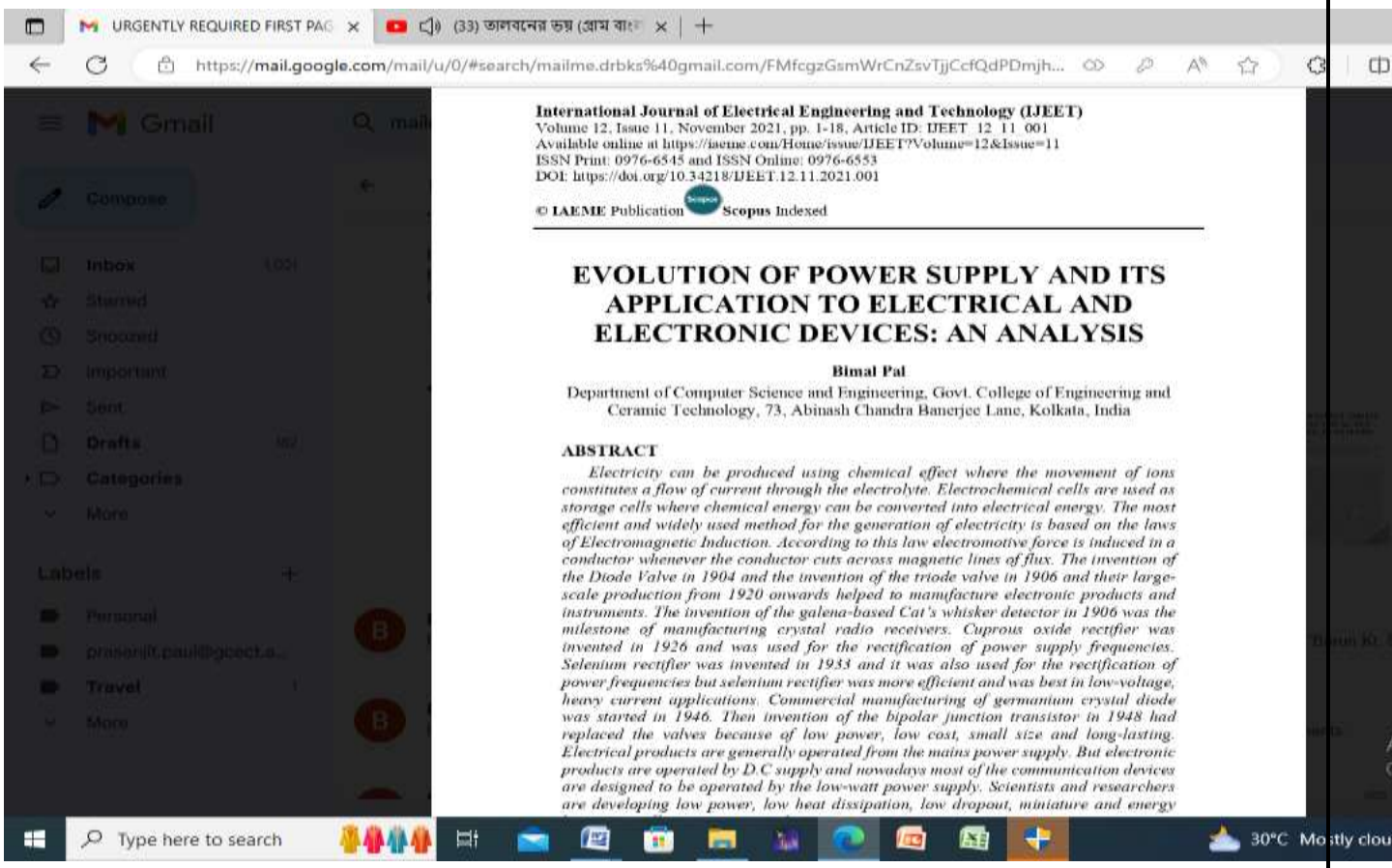
Unveiling the role of structure–property correlation and its validation towards engineering the application potential of sol–gel derived mesoporous gamma-alumina†

Savan Kumar Sharma, Paromita Das ‡ and Barun K. Sanfui *

In the present study, a comprehensive investigation has been carried out on the meticulously designed surfactant-free glycerol-activated sol–gel derived mesoporous γ-alumina powder, specifically with the aim to establish the excellent prospect of the structure–property relationship towards efficiently modifying and conceptually emphasizing the correlative outlook of the application perspective. Herein, the systematic engineering of the selective synthetic parameters such as peptizing acid type and its associated solvent create great strategic influence towards methodically tuning and judiciously constructing the prime controlling facet of the overall process, which successively maintains the distinctive individuality of the sol–gel derived mesoporous gamma-alumina structure. Interestingly, the initiation of discrepancy, which was recorded at the chemical nature site of the molecular bond structure of two distinctive boehmite sols, conspicuously maintains their individuality even while experiencing the sequential advancement of the dehydroxylation process, the consequential rearrangement of the hydroxyl group, alongside the concurrent progressive diffusion of Al^{3+} ion amongst the available co-ordination sites as a function of increasing temperature. Eventually, while dictating the individual identity of the evolved gamma-alumina's structure, the study aimed at acquiring identical distinctive characteristics even at their corresponding atomic scale, bulk structure, and surface textural features in terms of revealing the Rietveld, NMR (^{27}Al and ^{1}H), pyridine-FTIR, TEM, and XPS spectral analysis with the exploration of comparatively higher crystallinity, greater AlO_4/AlO_6 ratio, lower Lewis and Bronsted acid sites, lesser amount of hydroxyl groups, and lower extent of agglomeration tendency in inorganic acid peptized gamma-alumina as compared to organic acid peptized



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EVOLUTION OF POWER SUPPLY AND ITS APPLICATION TO ELECTRICAL AND ELECTRONIC DEVICES: AN ANALYSIS

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ABSTRACT

Electricity can be produced using chemical effect where the movement of ions constitutes a flow of current through the electrolyte. Electrochemical cells are used as storage cells where chemical energy can be converted into electrical energy. The most efficient and widely used method for the generation of electricity is based on the laws of Electromagnetic Induction. According to this law electromotive force is induced in a conductor whenever the conductor cuts across magnetic lines of flux. The invention of the Diode Valve in 1904 and the invention of the triode valve in 1906 and their large-scale production from 1920 onwards helped to manufacture electronic products and instruments. The invention of the galena-based Cat's whisker detector in 1906 was the milestone of manufacturing crystal radio receivers. Cuprous oxide rectifier was invented in 1926 and was used for the rectification of power supply frequencies. Selenium rectifier was invented in 1933 and it was also used for the rectification of power frequencies but selenium rectifier was more efficient and was best in low-voltage, heavy current applications. Commercial manufacturing of germanium crystal diode was started in 1946. Then invention of the bipolar junction transistor in 1948 had replaced the valves because of low power, low cost, small size and long-lasting. Electrical products are generally operated from the mains power supply. But electronic products are operated by D.C supply and nowadays most of the communication devices are designed to be operated by the low-watt power supply. Scientists and researchers are developing low power, low heat dissipation, low dropout, miniature and energy

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Skyrme fluid in anisotropic Universe

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Abstract. Cosmological solutions are obtained in anisotropic Kantowski–Sachs (KS) and Bianchi Type-I Universes considering a cosmological constant with Skyrme fluid. Interestingly, the solutions obtained here in both the KS and Bianchi-I anisotropic Universes are found to isotropise at late time due to the presence of the Skyrme fluid, even in the absence of Λ term or any inflationary mechanism involving the inflaton field. A comparative study of both the anisotropic cosmological models are carried out here and it is found that the Bianchi-I Universe admits oscillatory solutions for a given matter configuration. We also note that the emergent Universe model can be obtained with the Skyrme fluid. The anisotropy, deceleration and jerk parameters have been studied along with the linear perturbative stability to explore the efficacy of the models. Both cosmological models are stable in the absence of cosmological constant. Besides, their predictions are compatible with the observational data. Thus, we may claim that Skyrme fluid is a possible source of isotropization of an anisotropic Universe via accelerated expansion, which is capable of reproducing some features that can be observed in the Universe.

Keywords. Kantowski–Sachs; Bianchi-I; Skyrme fluid.

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Modified Chaplygin gas in anisotropic universes on the brane

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In this paper, we study anisotropic universes with Modified Chaplygin gas (MCG) in the context of Rand[illegible] The cosmological solutions for Kantowski-Sachs (KS) and Bianchi-I universes with MCG are obtained on the BS2 braneworld. The solutions are found to be dependent on MCG parameters but

Innovative Approach to Evaluate the Wearing of Nano-TiO_2-Doped Alumina Ceramics in the Light of Image Modeling

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The present research is emphasized on the microscopic observation of post-wear surface of nano-TiO_2-doped alumina ceramics to access wearing by promising image processing algorithms, namely, entropy analysis, Sobel edge detection technique, and entropy filtered image histogram analysis in relation to the extent of doping. The experimental results of specific wear-rate showed an indicator with the extent of microfracturing of grains, plowing of materials and debris formation on the wear track after a long wear cycle in terms of entropy level, edge density index, and entropy filtered image, and the nature of histogram at different doping levels. The lowest value of entropy level and edge density index is shown at the level of 1 wt%. TiO_2-doped alumina ceramics due to the presence of low number of granularity and microfracture grains on the wear track cause the lowering of specific wear-rate. The histogram of entropy filtered image for 1 wt% doping is more uniformly distributed with the highest frequency and lowest skewness factor over a wide range of intensity values.
[DOI: 10.1115/1.4051904]

Keywords: dry friction, wear, alumina-titania ceramics, image processing, edge detection, entropy analysis

1 Introduction

Wear is an important tribo-mechanical property of materials related to the progressive loss of material from the solid surface by mechanical interaction of two sliding surfaces under load [1]. Therefore, knowledge of wear-rate is of technical importance for accessing the life of the materials. Wear can quantitatively be measured by a mass loss method, dimensional change method, volume loss method in relation to testing parameter, contact geometries and environmental condition, etc. [2]. The incorporation of nano-additives in alumina ceramics improved wear resistance by modifying microstructure, inhibiting abnormal grain growth, and controlling the volume fraction and size distribution of nano-particles in reinforcing matrix [3]. The importance of alumina lies heavily in bio-ceramic owing to its properties like excellent corrosion resistance, good biocompatibility, low friction, high wear resistance, and high strength [4], which are indispensable properties for prosthesis technology. It is further observed that the addition of titania as a sintering aid in alumina sample improves the tribo-mechanical properties of the ceramic [5–7].

The present research scenario in material science and engineering are inclined towards interdisciplinary areas by adopting soft computing to explain the properties of engineering materials more accurately. Therefore, emerging research work should be framed to understand the properties of engineering materials more accurately by applying the algorithm of soft computing in an automated manner [8,9]. The scanning electron microscopic (SEM) image is a digital domain of two-dimensional (2D) intensity map. Each pixel of SEM image corresponds to the captured signal intensity at every point. Prolong action of mechanical stress on the surface of the specimen results in microfracturing, axial crack formation, and plowing of materials and debris formation. The morphological features of the worn-out surface are to accumulate the induced signals, and image processing techniques have been implemented to judge the specific wear-rate using different deterministic parameters of the image analysis methods [10]. Application of various image processing methods is found widely in the literature in various fields like remote sensing [11], medical field [12], encoding system [13], machine vision [14], color processing [15], pattern recognition [16], etc. Alturki et al. [17] measured the cavitation erosion on stainless steel surface by 2D discrete wavelet packet transform in terms of mean depth penetration (MDP). The result showed that MDP values were inversely proportional with corrosion in contact with the oil–water emulsion. The application of image processing techniques is in use in cutting tool wear prediction for a long time. Jurkovic et al. [18] have developed a flexible system that can measure tool wear with high spatial resolution and good accuracy. They have performed the digitization of the image followed by image analysis and finally evaluated a set of tool wear parameters. They used a vision system to measure tool wear using a charge-coupled device camera and laser diode with a linear projector. Wang et al. [19] measured flank wear in milling by analyzing successive images captured by a high-speed camera in a periodic manner without stopping the spindle. The successive operation-like edge detection by applying Sobel operator, edge enhancement, thresholding, edge line extraction, and morphological operation is used to obtain reference line of the image. Loizou et al. [20] developed an algorithm to monitor tool wear for a linear broaching based on the overall wear area. They automated the method with image cropping and digital image processing tools to determine the affected area without requiring any manual intervention. Thakre et al. [21] also developed an automatic calibrated system to monitor flank wear of carbide tool insert by a machine vision system by monitoring wear related parameters like average tool wear width, tool wear area, tool wear perimeter, etc. The vision system result of average tool wear lies within 3% error range with respect to the experimental results. Kerr et al. [22] also monitored tool wear of modern computer numerical control machine in real-time and established a good correlation with the expected wear characteristics. They showed that the extent of

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Electrical Engineering
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ORIGINAL PAPER

Application of Poincaré analogous time-split signal-based statistical correlation for transmission line fault classification

Alok Mukherjee[1] · Kingshuk Chatterjee[2] · Palash Kumar Kundu[3] · Arabinda Das[3]

Received: 9 February 2021 / Accepted: 22 July 2021

Abstract
A transmission line fault classification scheme is proposed in this article using Poincaré-based correlation analysis of three-phase fault currents. The method segments each fault signal into two equal time-split components and computes correlation coefficient between these two time-split signals. The fault current signals of the directly affected line(s) observe an abrupt monotonic rise, compared to the indirectly affected phases. This sudden rise in magnitude is expressed with correlation coefficients between the two almost consecutive time-split components of signal, time shifted by delay index. This method emphasizes this monotonic nature of increment of the fault current, enabling prompt fault detection. Further analysis of three phases of fault signals independently yields a set of correlation coefficients for ten different fault prototypes, which are used to develop fault classifier signatures for direct classification. The proposed method yields high classification accuracy of 99.76% using only (1/6)th of the post-fault noisy signal with fault resistance varying from 0.01 to 100Ω. Besides, analysis of only one end single discards the requirement of time synchronous signal acquisition from both ends. Finally, use of simple analysis reduces the computational burden compared to several contemporary methods.

Keywords Poincaré analysis · Time-split signal · Correlation coefficient · Fault intensity level · Fault classification · Delay index

1 Introduction

people and better protection of connected equipments from severe damage. This also helps to maintain system stability

APPLIED NEUROPSYCHOLOGY: ADULT
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Bilingualism as a protective factor in aphasia

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ABSTRACT

Background: Bilingualism may affect the profile of cognitive disturbances associated with stroke. Its impact on aphasia severity, however, is in need of substantiation.
Aims: To determine the relationship between bilingualism and vascular aphasia severity.
Methods: This is an observational cross-sectional study conducted on people with post-stroke aphasia. Our sample included 155 monolingual and 53 bilingual vascular aphasia patients. They were selected in a neurological hospital in Kolkata (West Bengal, India).
Results: The Bengali version of Western Aphasia Battery (BWAB) was used in this study. Aphasia severity was compared between monolingual and bilingual participants. The overall difference in the mean aphasia quotient (AQ) between bilingual and monolingual participants was statistically significant ($p = 0.009$). It was also found that in bilingual participants, aphasia was less severe in certain subgroups, namely: higher lesion volume, male gender, and sub-cortical stroke, while in none of the subgroups a monolingual advantage was documented.
Conclusion: Current results suggest that bilingualism represents a protective factor in vascular aphasia; this effect is observed particularly in some aphasia subgroups.

KEYWORDS
Aphasia; bilingualism; stroke

Introduction

Studies supporting the idea of bilingual advantage have gained significant scientific ground over the last decade or so. The idea of bilingualism being a protective factor in post-stroke aphasia stems from the observations that bilingual perspective of post-stroke cognitive difficulties as well as outcome in bilingual individuals. Alladi et al. (2016) studied 608 patients suffering ischemic strokes and analyzed the significance of bilingualism on post-stroke cognitive disturbances. The authors reported that no significant differences in

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Indoor Cardiovascular Health Monitoring System under COVID 19 Situations

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Abstract: In this article, we propose a health monitoring system, especially focused on detecting myocardial infarction chances and raising the alarm when required. The device would be able to identify malfunctioning of the heart using the ECG signals taken using ARDUINO-based portable and affordable sensors. Here, we have described the development of two major schemes of health monitoring. We have developed a method of identifying the maloperation of the heart by using the second lead of the ECG signal. This method is based on a modified Poincaré analysis, which effectively distinguishes the diseased heart ECG from the normal heart ECG signals. The Poincaré-based scheme is tested using five different diseased ECG signals from the PTB database, and a high disease identification efficiency of 82% is achieved. Here we further propose implementing this analysis within the ARDUINO-based health monitoring board so that patients would get an opportunity to monitor their heart condition at some regular intervals staying at home and follow up with a physician if any abnormality is detected. This entire scheme is more useful, especially under this COVID 19, pandemic situation when moving outside the home is a challenge in itself. Hence, the proposed device would be

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ORIGINAL CONTRIBUTION

Supervised Learning Aided Multiple Feature Analysis for Freshness Class Detection of Indian Gooseberry (*Phyllanthus emblica*)

Tanmay Sarkar[1] · Alok Mukherjee[2] · Kingshuk Chatterjee[2]

Received: 15 May 2021 / Accepted: 22 September 2021

Abstract A supervised learning-based simple three class freshness detection algorithm is presented in this paper for prediction of freshness of Amla samples. Six major features from the red–green–blue (RGB) and hue–saturation–vital component (HSV) colourspace and ten other minor features have been studied here with the proposed artificial neural network (ANN) model. The proposed freshness classifier is computationally light due to the use of only ANN as the major classifying tool. More importantly, the analysis is based on images captured on smart phone only, which enables portability and hence, wide acceptability of the scheme. Accuracy of classification higher than 96.5% is achieved using the hue histogram of the image, followed by green layer histogram and others. All the major features

Keywords Major and minor feature · Feature extraction · Freshness class · Artificial neural network (ANN) · Accuracy of classification

Introduction

An intense relationship can be established between food quality and customer satisfaction. Customers always play a key role while determining the food quality. Customer satisfaction about each quality attribute of a product contributes to the overall quality, in order to make assurance about the food product quality and also to safeguard the seafood market quality maintenance is now extremely

Journal of Biosystems Engineering
https://doi.org/10.1007/s42853-021-00116-8

ORIGINAL ARTICLE

Freshness Assessment of Indian Gooseberry (*Phyllanthus emblica*) Using Probabilistic Neural Network

Alok Mukherjee[1] · **Tanmay Sarkar**[2] · **Kingshuk Chatterjee**[1]

Received: 24 May 2021 / Revised: 23 September 2021 / Accepted: 27 September 2021

Abstract

Purpose In this paper, a probabilistic neural network (PNN)-based simple model for the detection of freshness in Indian gooseberry or amla (*Phyllanthus emblica*) samples has been developed.

Methods The amla images have been analyzed using two features: hue histogram, which is a kind of color representative of the image, and entropy analysis, which corresponds to texture analysis of the sample images. Three freshness classes have been assigned depending on the freshness of the samples and governed by the Hedonic scale.

Results The proposed PNN model is also tested with five different activation functions; out of which, radial and triangular basis functions are found to yield the most accurate results. Moreover, the hue-PNN model is found to possess marginal superiority over the entropy-PNN model, thus signifying the higher effectiveness of the former in the proposed work. The proposed work is computationally lighter as it contains PNN as the single analysis tool, aided by the image histograms. Moreover, the experiments have been conducted with the images captured using smartphones only, which establishes the portability of capturing images.

Conclusions High freshness classification accuracy of 97.5%, ease of implementation, and use of smartphone captured images widen its practical applicability of developing into a smartphone application-based module.

Keywords Amla · Freshness classification · Hue histogram · Entropy image histogram · Probabilistic neural network (PNN) · Activation function

Food Analytical Methods
https://doi.org/10.1007/s12161-021-02161-7

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Comparative Analysis of Statistical and Supervised Learning Models for Freshness Assessment of Oyster Mushrooms

Tanmay Sarkar[1] · Alok Mukherjee[2] · Kingshuk Chatterjee[2] · Mohammad Ali Shariati[3,4] · Maksim Rebezov[3,4,5] · Svetlana Rodionova[3] · Denis Smirnov[3] · Ruben Dominguez[6] · Jose M. Lorenzo[6,7]

Received: 18 October 2021 / Accepted: 26 October 2021

Abstract
Automatic assessment of the quality of fruits and vegetables is a growing field of research in this modern era in order to enable faster processing of good quality foods. In this work, we have analyzed ten major colour variant features of two sets of oyster mushrooms in terms of histograms of each layer of the red–green–blue colourmap, hue-saturation-vital component colourmap, luminance-chrominance colourmap and the greyscale image. Besides, texture analysis has been carried out using entropy window filtering. Apart from that, five other minor features, such as mean, standard deviation, entropy, kurtosis and skewness of each of these layers, and four other greyscale features, such as contrast, correlation, energy and homogeneity are analyzed in this work. Two different freshness assessment models employing statistical methods like principal component analysis (PCA) and supervised learning algorithms such as artificial neural network (ANN) have been used here to investigate the different features of the mushroom images and classify the same into fresh and deteriorated classes. Analysis revealed that the ANN classifier outperforms the PCA threshold classifier with almost all the features. The highest classifier accuracy is obtained as 94.4% using the ANN model and 93.3% using the PCA threshold freshness detector. Most importantly, the use of smartphones ensures portability, as well as the possibility of widespread application of the proposed models.

Keywords Oyster mushroom · Major and minor feature · Freshness class · Artificial neural network (ANN) · Food safety

Introduction

carbohydrate (45–48%), fibre (11–13%), vitamins and essential amino acids (Dibaba and Abera 2017; Li et al. 2021)

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Edge Detection Aided Geometrical Shape Analysis of Indian Gooseberry (*Phyllanthus emblica*) for Freshness Classification

Tanmay Sarkar[1] · Alok Mukherjee[2] · Kingshuk Chatterjee[2] · Vladimir Ermolaev[3] · Dmitry Piotrovsky[4] · Kristina Vlasova[4] · Mohammad Ali Shariati[4] · Paulo E. S. Munekata[5] · Jose M. Lorenzo[5,6]

Received: 26 November 2021 / Accepted: 7 December 2021

Abstract
This paper presents a freshness classification model for determining the quality of amla (*Phyllanthus emblica*) using features extracted from the progressively deteriorating shapes. Estimation of the peripheral distance from the centroid is carried out to develop key features regarding the shape of the samples, followed by developing two classifier models using support vector machine (SVM) and artificial neural network (ANN) to segment the samples into *Good* and *Deteriorated* classes. The proposed algorithm is simple in analysis as it includes geometry-based computation for identifying the surface irregularities and shape changes occurring due to aging the samples. Canny edge detection model is used to obtain the peripheral edges, followed by analyzing the same using "ConvexImage." High accuracy of classification, exceeding 90%, is achieved in most cases, using three different feature parameters so developed, either as univariate or multivariate schemes of analysis. Besides, the sample images are captured using smartphones only. Thus, high accuracy of freshness classification, along with ease of analysis and image capturing using the phone camera itself, makes the algorithm suitable for implementing in low memory devices such as smartphones, which would also make the proposed model more widely exploring.

Keywords Amla · Food safety · Quality control · Canny edge detection

Tanmay Sarkar and Alok Mukherjee contributed equally

Introduction

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J. Inst. Eng. India Ser. B
https://doi.org/10.1007/s40031-021-00710-6

ORIGINAL CONTRIBUTION

Artificial Neural Network based Dimension Prediction of Rectangular Microstrip Antenna

Pinaki Mukherjee[1] · **Alok Mukherjee**[1] · **Kingshuk Chatterjee**[1]

Received: 18 October 2020 / Accepted: 24 December 2021

Abstract A computational method for the prediction of dimensions of a microstrip antenna has been proposed in this work. The model uses artificial neural network (ANN) as the chief designing tool for the development of the predictor model. The ANN structure has been designed to take three major output parameters as input, viz. resonant frequency, fractional bandwidth and return loss. The outputs of the model are assigned as the three major design parameters of the antenna model: length, width and position of feed point. Equal number of input and output parameters of the model enhances the importance of the model. Backpropagation topology has been adopted while designing the ANN structure. Validation of the proposed ANN model is carried out by designing and simulating the prototype antenna models using the predicted dimensions in IE3D software. The proposed model yields an average

Introduction

Microstrip patch antenna (MPA) is a popular name in the field of antenna technology, especially due to the numerous advantages, it offers like light weight, compact as well as flexible structure and design, etc. although it suffers from its major drawback of narrow bandwidth. Hence, microstrip and printed antennas have a wide range of applicability, especially in fields like Global Positioning System (GPS), Bluetooth automotive applications with RHCP, Satellite Digital Audio Radio Services (SDARS) and so on. Designing highly accurate antennas for a particular application in different fields is a great challenge for the engineers. These antennas are characterized by a large number of physical parameters compared to the conventional microwave antennas, thus enhancing the design compli-

Current Research in Food Science 5 (2022) 432–450

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Review Article

Application of bio-inspired optimization algorithms in food processing

Tanmay Sarkar [a,**], Molla Salauddin [b], Alok Mukherjee [c], Mohammad Ali Shariati [d], Maksim Rebezov [d,e,f], Lyudmila Tretyak [g], Mirian Pateiro [h,*], José M. Lorenzo [h,i]

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ARTICLE INFO

Keywords:
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Food process optimization
Nature-inspired algorithm
Food industry

ABSTRACT

Bio-inspired optimization techniques (BOT) are part of intelligent computing techniques. There are several BOTs available and many new BOTs are evolving in this era of industrial revolution 4.0. Genetic algorithm, particle swarm optimization, artificial bee colony, and grey wolf optimization are the techniques explored by researchers in the field of food processing technology. Although, there are other potential methods that may efficiently solve the optimum related problem in food industries. In this review, the mathematical background of the techniques, their application and the potential microbial-based optimization methods with higher precision has been surveyed for a complete and comprehensive understanding of BOTs along with their mechanism of functioning. These techniques can simulate the process efficiently and able to find the near-to-optimal value expeditiously.

Food Analytical Methods
https://doi.org/10.1007/s12161-022-02241-2

Development of Artificial Vision System for Quality Assessment of Oyster Mushrooms

Alok Mukherjee[1] · Tanmay Sarkar[2] · Kingshuk Chatterjee[1] · Dibyajit Lahiri[3] · Moupriya Nag[3] · Maksim Rebezov[4,5] · Mohammad Ali Shariati[6] · Alevtin Miftakhutdinov[7] · Jose M. Lorenzo[8,9]

Received: 13 January 2022 / Accepted: 21 February 2022

Abstract
In this paper, we have illustrated a simple and effective method of assessing the fresh and deteriorated oyster mushroom samples. Analysis of correlation coefficients is done very effectively here to identify the interrelationship of different color layers of the RGB and HSV color map of the samples, as this degrades progressively. These correlation features are further analyzed using two supervised learning models incorporating support vector machine (SVM) and artificial neural network (ANN) to develop a simple classifier model to identify the two different classes of the mushroom images. The proposed work is simple as it includes a simple computational supervised model, and, more importantly, it is very effective as it explores the interrelation between the different layers of two different color maps of the image samples. The highest classifier accuracy achieved using ANN and SVM models exceeds 95% and 98% respectively; and the mean accuracy level from fifty such observations stands 94.7% and 93.4%, which are high considering contemporary researches. High accuracy of classification, simplicity of analysis and image acquisition through smartphones makes the proposed work suitable for implementing in application-based software for smartphone users which would further enhance the wide applicability of the proposed mushroom classifier scheme.

Keywords Mushroom · Freshness classification · Correlation coefficient · Food safety · Quality control

J. Inst. Eng. India Ser. A
https://doi.org/10.1007/s40030-022-00616-6

ORIGINAL CONTRIBUTION

Correlation-Aided 3D Vector Distance Estimation-Based Quality Assessment of Indian Gooseberry

Tanmay Sarkar[1] · **Alok Mukherjee**[2] · **Kingshuk Chatterjee**[2]

Received: 16 November 2021 / Accepted: 12 January 2022

Abstract In this paper, it has been developed a statistics-based method for the quality assessment and classification of amla (Indian gooseberry). The proposed binary classification of the amla fruits has been achieved using a simple statistical analysis incorporating the correlation coefficient of the image features. Here, the sample images were captured and analysed for the red green blue (RGB) and hue saturation (HS) layers. We have developed the histograms of these layers were developed and investigated the correlation coefficient between each of the layers taken pairwise. These cross-correlation values have been studied extensively to identify three of the most important and significant pairs of features which produced distinctive correlation coefficient values between the good and the bad

Keywords Freshness class · Centroid · Food safety · Postharvest management

Introduction

Indian gooseberry (*amla*) is well known for its diverse health benefits. For years, it has been consumed to boost up human health. It can act against diarrhoea, constipation, diabetes, asthma and heart diseases [1, 2]. The most important fact which makes *amla* nutritionally rich is the high content of vitamin C in it [1]. Owing to its antioxidant activity, regular use of *amla* in diet healthifies immune system as well as the digestive system and also fights

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https://doi.org/10.1007/s12161-022-02287-2

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Quality Assessment of Tindora (*Coccinia indica*) Using Poincare Plot and Cartesian Quadrant Analysis

Tanmay Sarkar[1] · Alok Mukherjee[2] · Kingshuk Chatterjee[2] · Saule Ospandiyarovna Akhmetova[3] · Aigul Surapovna Alipbekova[4] · Marina Temerbayeva[5] · Mohammad Ali Shariati[6] · Maksim Rebezov[6,7] · Jose Manuel Lorenzo[8,9]

Received: 28 March 2022 / Accepted: 3 April 2022

Abstract
Tindora or ivy gourd (*Coccinia indica*) is a tropical vegetable and has the potential to become popular worldwide due to its rich nutritional characteristics, adaptability to adverse environmental condition and fast fruiting nature. The fresh samples are bright green (good) in colour; it turns yellow (intermediate quality) and ultimately turns bright red (bad or inedible as vegetable). In this paper, tindora is classified using two different colour representations of the image matrix, namely RGB and HSV. In the RGB representation, intensity of the green layer versus intensity of the red layer for each pixel position is plotted. The shape of the plot enables us to identify the tindora quality. In the case of HSV representation, the hue layer is used for classification purposes. The hue layer matrix is vectorized and the Poincare plot is computed. The distribution of the Poincare plot is analysed using Cartesian quadrant system. Based on the analysis, tindora quality is determined. The accuracy of the tindora classification using RGB representation is 68.67 and HSV representation is 94.33. The classifier used in both the representations after feature extraction is primarily threshold based and hence has low computational burden. The low computational burden makes the method ideal for incorporation into smartphones in the form of an app.

Keywords Vegetables · Food quality inspection · Artificial intelligence · Image analysis

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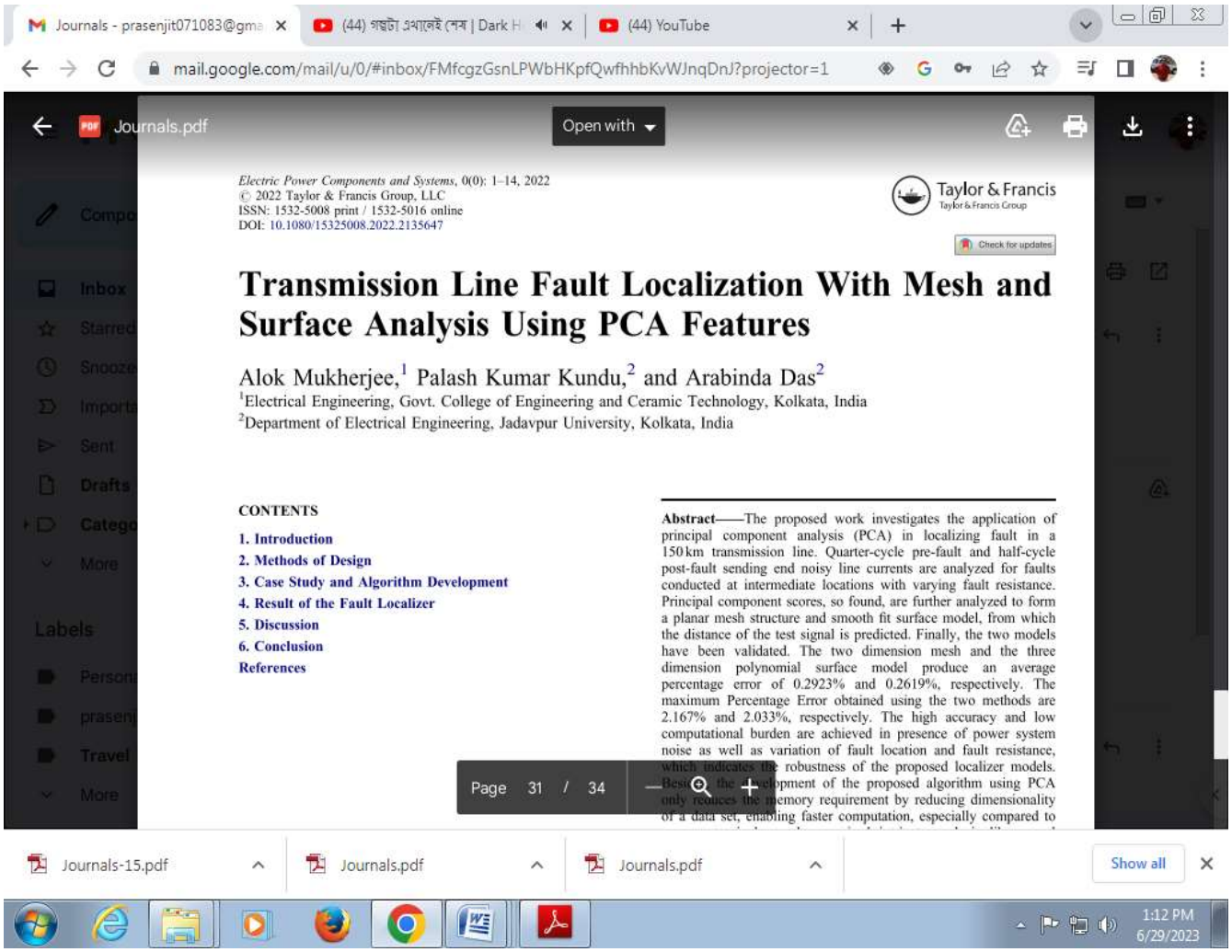
Computer Science, University of Petroleum and Energy Studies

DETECTION OF EDIBILITY OF AMLA (*Emblica officinalis*) THROUGH PCA BASED IMAGE ANALYSIS

Abstract. *Identification of edibility of fruit samples is very essential, as well as difficult. This is more applicable in places where bulk fruits are used in different automated factories, where investigation of each fruit manually is an impossible task. In this work, we have proposed a principal component analysis (PCA) based threshold classifier scheme for the identification of edibility of amla fruits. We have analyzed only the hue histogram of the image samples using PCA to segregate the samples into Good, Intermediate or Bad classes. Use of analysis like PCA reduces the computational burden many folds compared to the other supervised learning models involving variants of neural network, or mathematically heavier transform based models like wavelet or Fourier transforms. The model is validated using*



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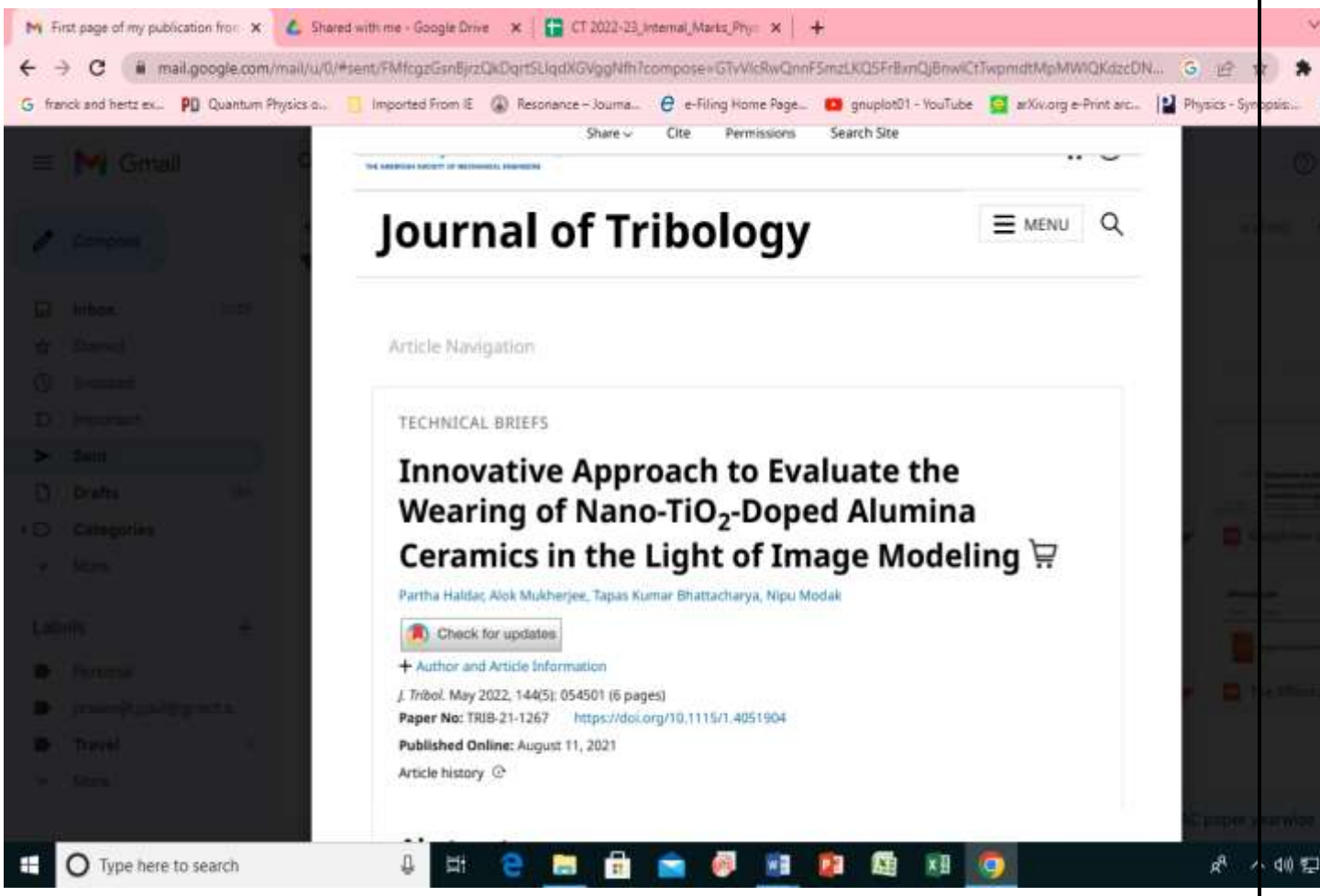
Transmission Line Fault Localization With Mesh and Surface Analysis Using PCA Features

Alok Mukherjee,[1] Palash Kumar Kundu,[2] and Arabinda Das[2]
[1]Electrical Engineering, Govt. College of Engineering and Ceramic Technology, Kolkata, India
[2]Department of Electrical Engineering, Jadavpur University, Kolkata, India

CONTENTS

Abstract——The proposed work investigates the application of principal component analysis (PCA) in localizing fault in a 150 km transmission line. Quarter-cycle pre-fault and half-cycle post-fault sending end noisy line currents are analyzed for faults conducted at intermediate locations with varying fault resistance. Principal component scores, so found, are further analyzed to form a planar mesh structure and smooth fit surface model, from which the distance of the test signal is predicted. Finally, the two models have been validated. The two dimension mesh and the three dimension polynomial surface model produce an average percentage error of 0.2923% and 0.2619%, respectively. The maximum Percentage Error obtained using the two methods are 2.167% and 2.033%, respectively. The high accuracy and low computational burden are achieved in presence of power system noise as well as variation of fault location and fault resistance, which indicates the robustness of the proposed localizer models. Besides, the development of the proposed algorithm using PCA only reduces the memory requirement by reducing dimensionality of a data set, enabling faster computation, especially compared to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Recent Studies on Applications of Schiff Bases and Their Complexes in Atmospheric Carbon Dioxide Capture

Debdulal Maity

Russian Journal of General Chemistry **90**, 2473–2483 (2020) | Cite this article

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Abstract

Over many decades, global warming induced by the rising level of atmospheric carbon dioxide appeared to be the point of high concern. Energy demand in running the modern civilisation is mainly fulfilled by combustion of fossil fuels, which, in turn, produces carbon dioxide as a

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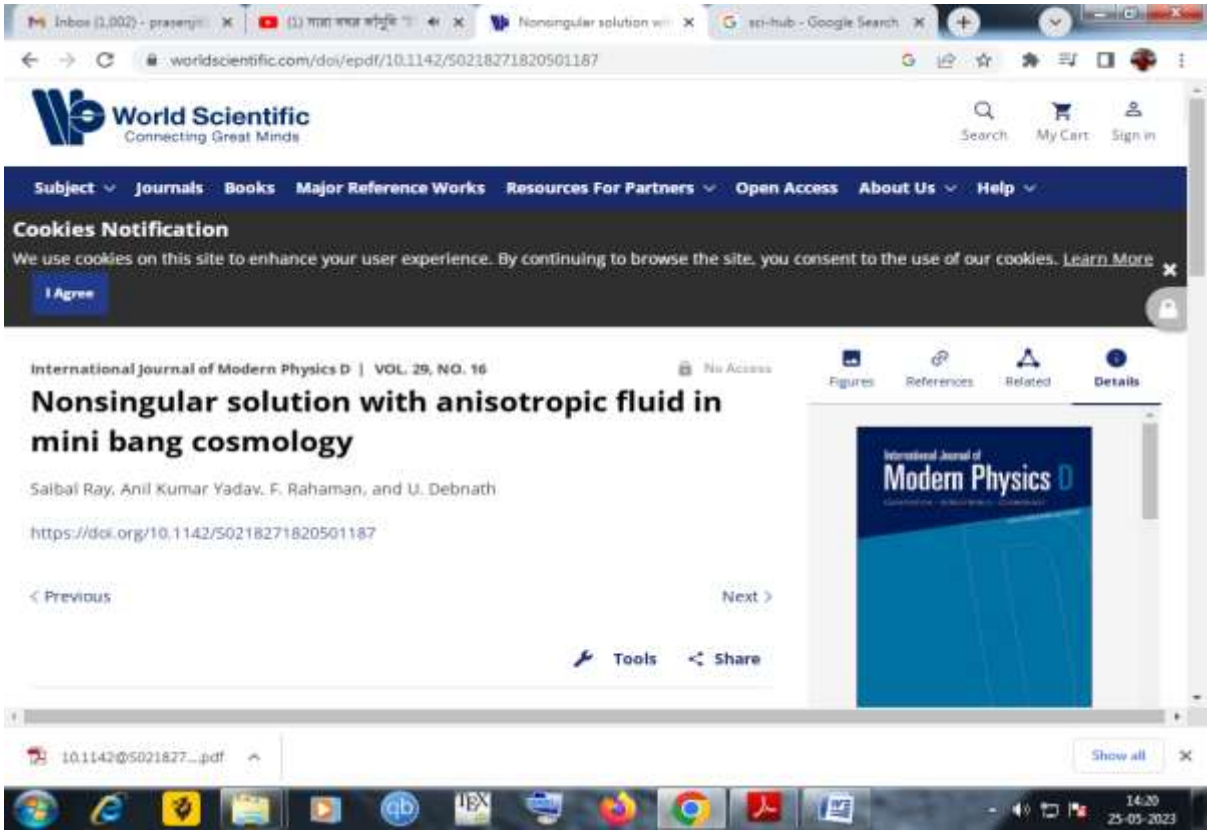
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Nonsingular solution with anisotropic fluid in mini bang cosmology
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Published: 02 September 2020

A novel decision-based adaptive feedback median filter for high density impulse noise suppression

Kamarujjaman, Mausumi Maitra ✉ & Susanta Chakraborty

Multimedia Tools and Applications **80**, 299–321 (2021) | Cite this article

Abstract

The qualitative performances of the digital image processing methods are degraded due to the presence of impulse noise. The conventional median filter and its advanced versions somehow manage to remove the noise from image but cannot preserve the image details. In this paper, a novel decision based adaptive feedback median filter is proposed to suppress the high density noise and preserve the details of the image. The proposed method detects the corrupted or noisy pixels by analyzing the neighbours in a decisive manner, which is a challenging task for the different types of images and noise. It predicts a local threshold by analyzing the neighbours to decide the adaptive nature of the feedback median filter. The feedback mechanism is adapted to enhance the qualitative results. Various types of images and noise densities have been used to evaluate the performance of the proposed method. The qualitative

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Wormhole solutions in $f(R)$ gravity

B. Mishra, A. S. Agrawal, S. K. Tripathy, and Saibal Ray

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Abstract

In this work, we studied the traversable wormholes geometry in $f(R)$ theory gravity, where R is the Ricci scalar. The wormhole solutions for some assumed $f(R)$ functions are presented. The assumption of $f(R)$ is based on the fact that its behavior changed with an assumed parameter α rather than the deceleration parameter. Three models are

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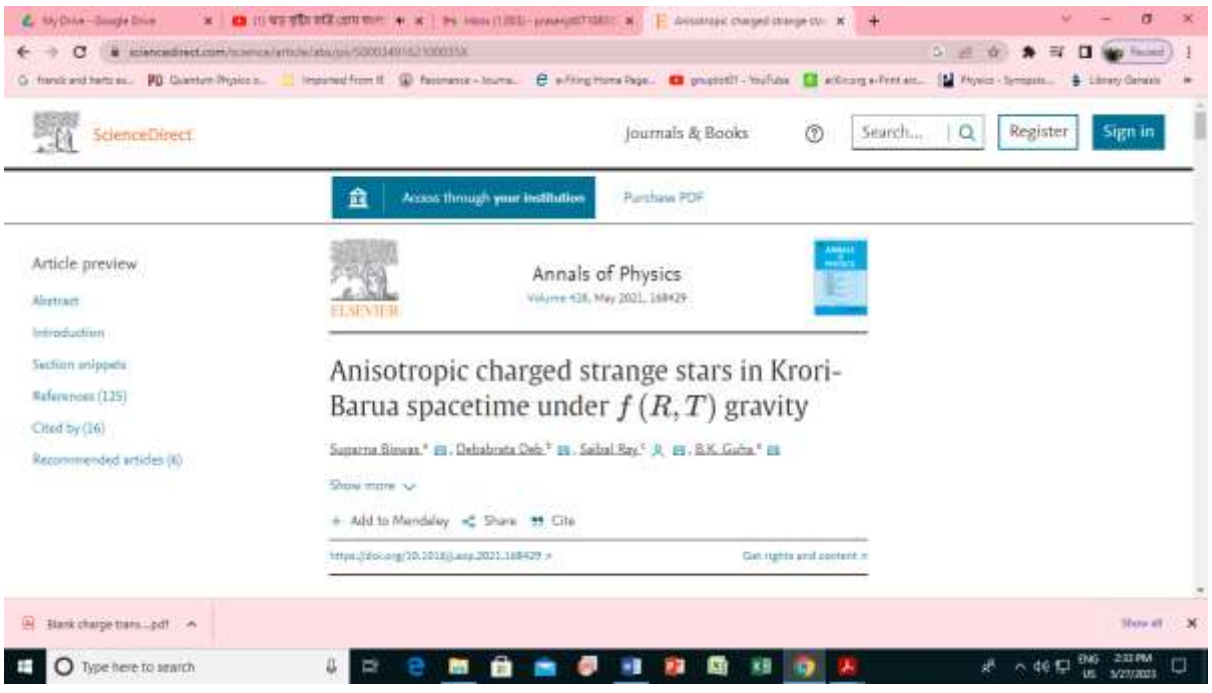

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Anisotropic charged strange stars in Krori-Barua spacetime under $f(R,T)$ gravity

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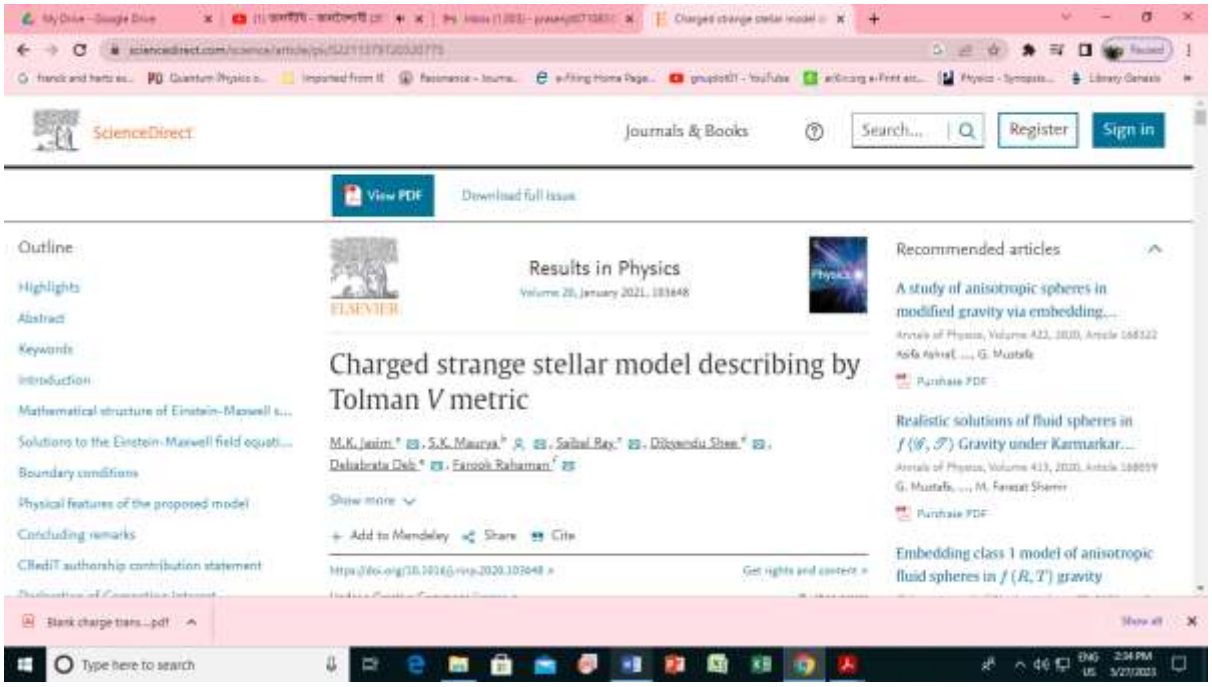
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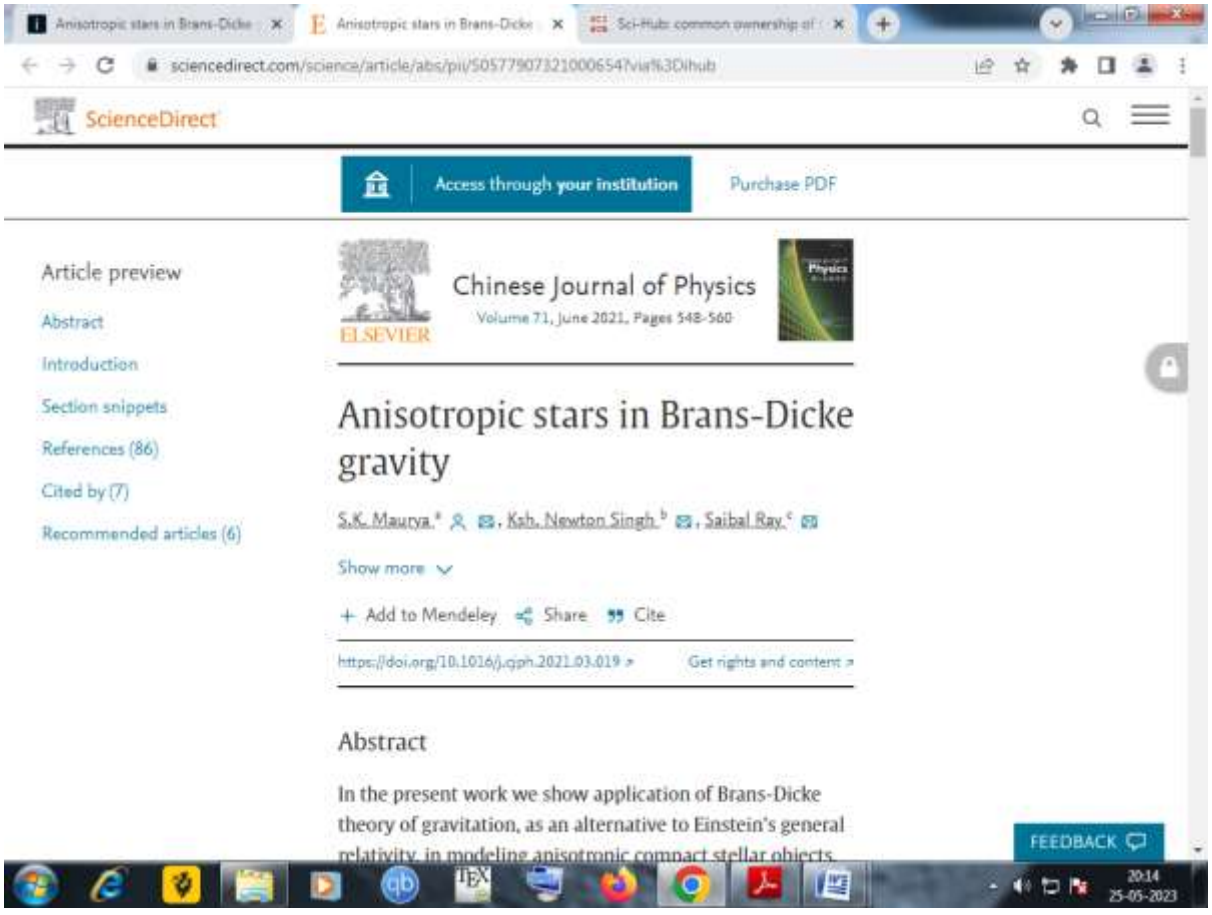
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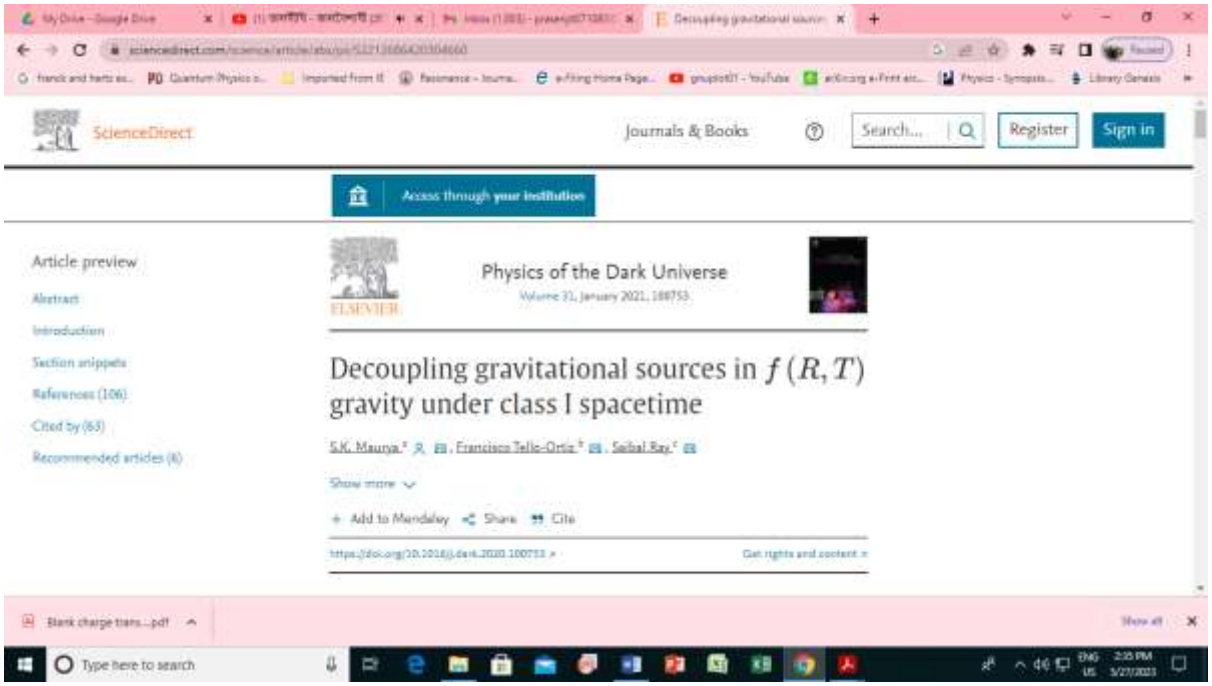

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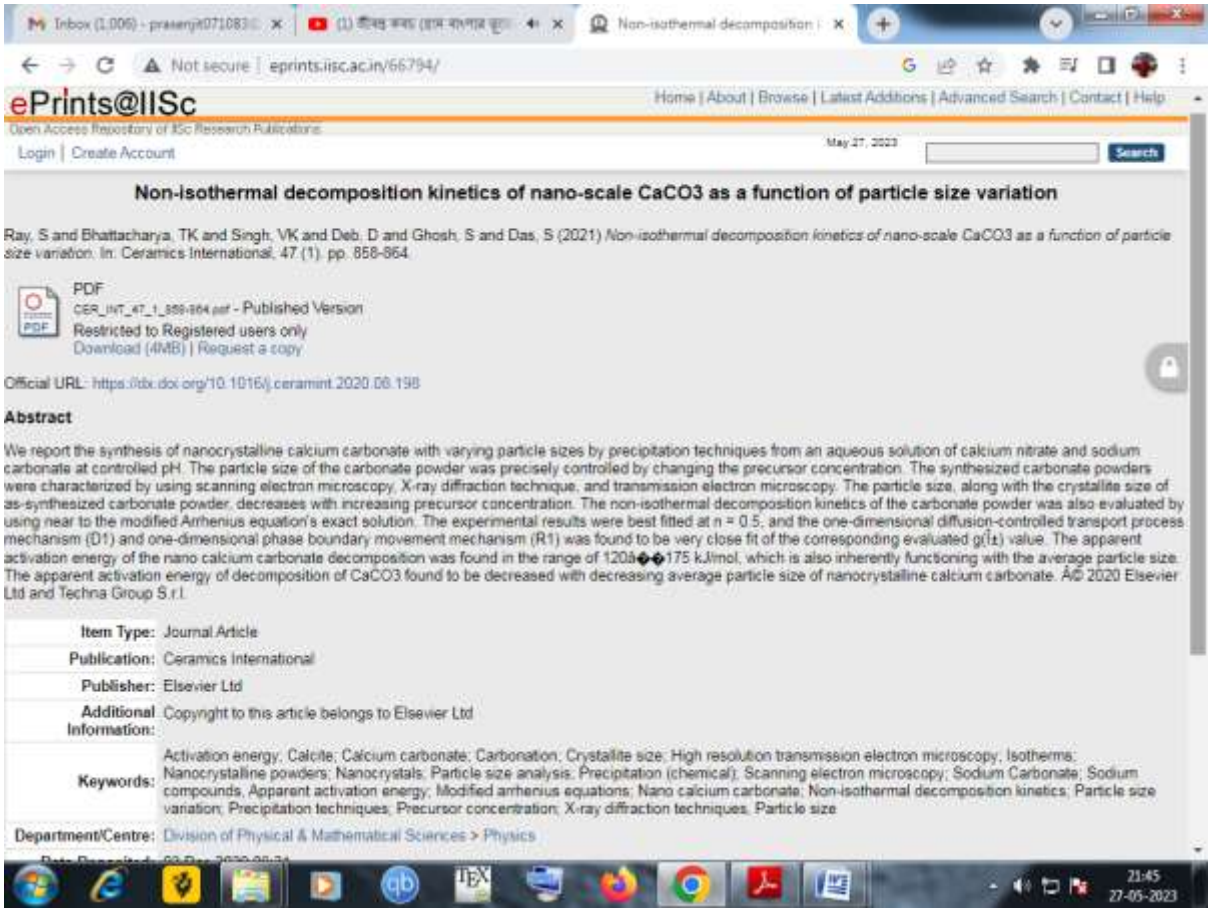

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Abstract

We report the synthesis of nanocrystalline calcium carbonate with varying particle sizes by precipitation techniques from an aqueous solution of calcium nitrate and sodium carbonate at controlled pH. The particle size of the carbonate powder was precisely controlled by changing the precursor concentration. The synthesized carbonate powders were characterized by using scanning electron microscopy, X-ray diffraction technique, and transmission electron microscopy. The particle size, along with the crystallite size of as-synthesized carbonate powder, decreases with increasing precursor concentration. The non-isothermal decomposition kinetics of the carbonate powder was also evaluated by using near to the modified Arrhenius equation's exact solution. The experimental results were best fitted at n = 0.5, and the one-dimensional diffusion-controlled transport process mechanism (D1) and one-dimensional phase boundary movement mechanism (R1) was found to be very close fit of the corresponding evaluated g(α) value. The apparent activation energy of the nano calcium carbonate decomposition was found in the range of 120â��175 kJ/mol, which is also inherently functioning with the average particle size. The apparent activation energy of decomposition of CaCO3 found to be decreased with decreasing average particle size of nanocrystalline calcium carbonate. Â© 2020 Elsevier Ltd and Techna Group S.r.l.

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Dilaton-Axion Black Hole under the Solar System Tests

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ABSTRACT

In the present paper we study the static and spherically symmetric dilaton-axion black hole in the testing ground of the Solar system. We constrain the parameters of the string motivated dilaton-axion form of the classical tests of general relativity, viz., the perihelion precession of the planet Mercury and the deflection of light by the Sun. In this case we have two free parameters: the dilaton strength and the point of curvature singularity of black hole. We obtain the permissible range of these two parameters from theoretical analysis based on the model and later compare them with the observations.

1. Introduction

The remarkable discovery of gravitational wave from the merger of black holes in a distant galaxy and capturing an image of a black hole's silhouette has led us to an exciting era of astronomy, where we have accomplished what was previously thought to be impossible (Abbott, 2016). These observations provide circumstantial evidence for the existence of black holes, as we cannot directly observe it. The idea of these bizarre objects in space, which are so massive and dense that light could not escape it, has been around for centuries. Most famously, black holes were predicted by Einstein's theory of general relativity, which showed that when a massive star dies, it leaves behind a small, dense remnant core, that has undergone a cataclysmic explosion known as a core-collapse supernova.

Presently we have good observational evidence that black holes exist throughout the universe. For example, it is thought that most galaxies in the Universe, including the Milky Way, contain a supermassive black hole at their center - with masses millions or even billions of times that of the Sun. There are also evidences of many black holes with much lower masses (ranging from a few to a few dozen times of the Sun's mass), throughout the galaxy.

Alongside this substantial progress in the direct as well as indirect observations on black holes, there have been dramatic improvements in our theoretical understanding of black holes. Over the past decade, some remarkable studies have been made to investigate the black hole solutions in various alternative theories of gravity, particularly theories of gravitation with background scalar and pseudo-scalar fields (Bekenstein, 1974). Such fields are non-minimally coupled to gravity and thus black hole solutions exist only for some specific choice of couplings (Horowitz, 1992). This type of specific couplings naturally arise in low energy effective string theory models and are comprised of two massless scalar fields - the dilaton and the axion. Recently Sur et al. (2005) have employed the dilaton and axion fields coupled to the electromagnetic field in a more generalized coupling in four dimensions by using the low energy action. Exploiting this new idea, they have found both asymptotically flat and non-flat dilaton-axion black hole solutions. The dilaton field has substantial cosmological as well as astrophysical implications and therefore is a subject of great interest in cosmology (Gasperini and Veneziano, 2003) and in the context of charged black holes (Horowitz, 1992; Ghosh and SenGupta, 2008; Usmani et al., 2010; Radinschi et al., 2010; Yang et al., 2011f; Ghosh and SenGupta, 2017; Gibbons and Maeda, 1988; Garfinkle et al., 1991).

In this paper, motivated by the above mentioned works, we study the astrophysical tests on the black hole. To establish this we shall favor the geometry of the exterior of a compact stellar type object (the Sun), which is the static and spherically symmetric, metric as proposed by Sur et al. (2005).

The plan of our study is as follows: In the next Sec. 2 we discuss the spherically symmetric solution in the string inspired theory of gravity with scalar coupled to electromagnetic gauge field. Further, in Sec. 3 we investigate the dilaton-axion black hole in the Solar system and perform classical tests of general relativity, viz., the perihelion precession of mercury and the deflection of light by the Sun using which we

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THE EUROPEAN PHYSICAL JOURNAL H

Regular Article

N.R. Sen: Father of Indian Applied mathematics

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Abstract Nikhilranjan Sen (1894–1963), popularly known as N.R. Sen, is known as the Father of Applied Mathematics and founder of the Calcutta School of Relativity Theory. He did Ph.D. in Berlin under the Nobel Laureate Max von Laue. In Berlin he came in contact with renowned physicists like Max Planck, Albert Einstein and their contemporaries. The present article, which is based on the primary sources, discusses the lesser known facts of his life, like the beginning of scientific career, background of his D.Sc. as well as Ph.D. theses, and detailed summary of his scientific works.

1 Introduction

Nikhil Ranjan Sen (May 23, 1894–January 13, 1963) also written as Nikhilranjan Sen or N.R. Sen (abb. NRS) was one of the initiators of the research in General Theory of Relativity in India. He belonged to the generation of M.N. Saha, known for his Saha ionization equation (Saha 1920) and S.N. Bose, famous for his Bose–Einstein statistics (Bose and Einstein 1924–1925). He was closer to the latter and its memorable that Bose wrote Sen's obituary for "Nature" (Bose 1963a).

NRS was the Founder Member of the Indian National Science Academy (INSA). The Academy published his short biographical sketch (Burman 1963). Recently, as a part of discussion on the role of Calcutta University in the development of Mathematics in India, the scientific contribution of N.R. Sen has been very scantly highlighted (Bhattacharjee, Mukherji and Mallik 2013). To the best of our knowledge, none of the published articles on NRS deals properly with the formative years of his life in Kolkata and Berlin chapter. Also, his scientific work is not discussed in entirety throughout his career with full professionalism in varied research areas of applied mathematics, especially in the field of budding Relativistic Cosmology and Astrophysics. The present article intends to fill the gap.

In the following we give:

1. A short biography
2. Career: Background of his D.Sc. and Ph.D. theses
3. Scientific works: Detailed summary

2 N.R. Sen: a short biography

As far as biography of NRS is concerned, unless not explicitly referred to, the following biographical details are based on the following sources available in the literature (Bose 1963b; Burman 1966; Mukherjee and Bhattacharjee 2014; Singh 2019).

Nikhilranjan Sen, son of Kalimohan Sen and Bidhumukhi Devi, was born on May 23, 1894, in the Dacca district of undivided India (now in Bangladesh). Kalimohan was a reputed advocate of Dacca court. Nikhilranjan passed Entrance Examination in 1909 from Rajsahi Collegiate School winning a first grade Government Scholarship. In 1913, he did B. Sc. with Honours in Mathematics, as student of Presidency College, Calcutta (presently Kolkata). Then, he entered Calcutta University M. Sc. Course in Mixed Mathematics (afterward known as Applied Mathematics). In M. Sc. classes, Sen had the opportunity of learning from two famous Professors, viz. C.E. Cullis and D.N. Mallick who taught in postgraduate classes. However, due to his ailment, Nikhilranjan could not appear in the M.Sc. Final Examination in 1915. In the following year, he passed that examination securing First Class First position.

In 1917, the first appointments were made at the newly founded College of Science and Technology, University of Calcutta. According to the annual report of syndicate, Prof. Ganesh Prasad, while presenting the

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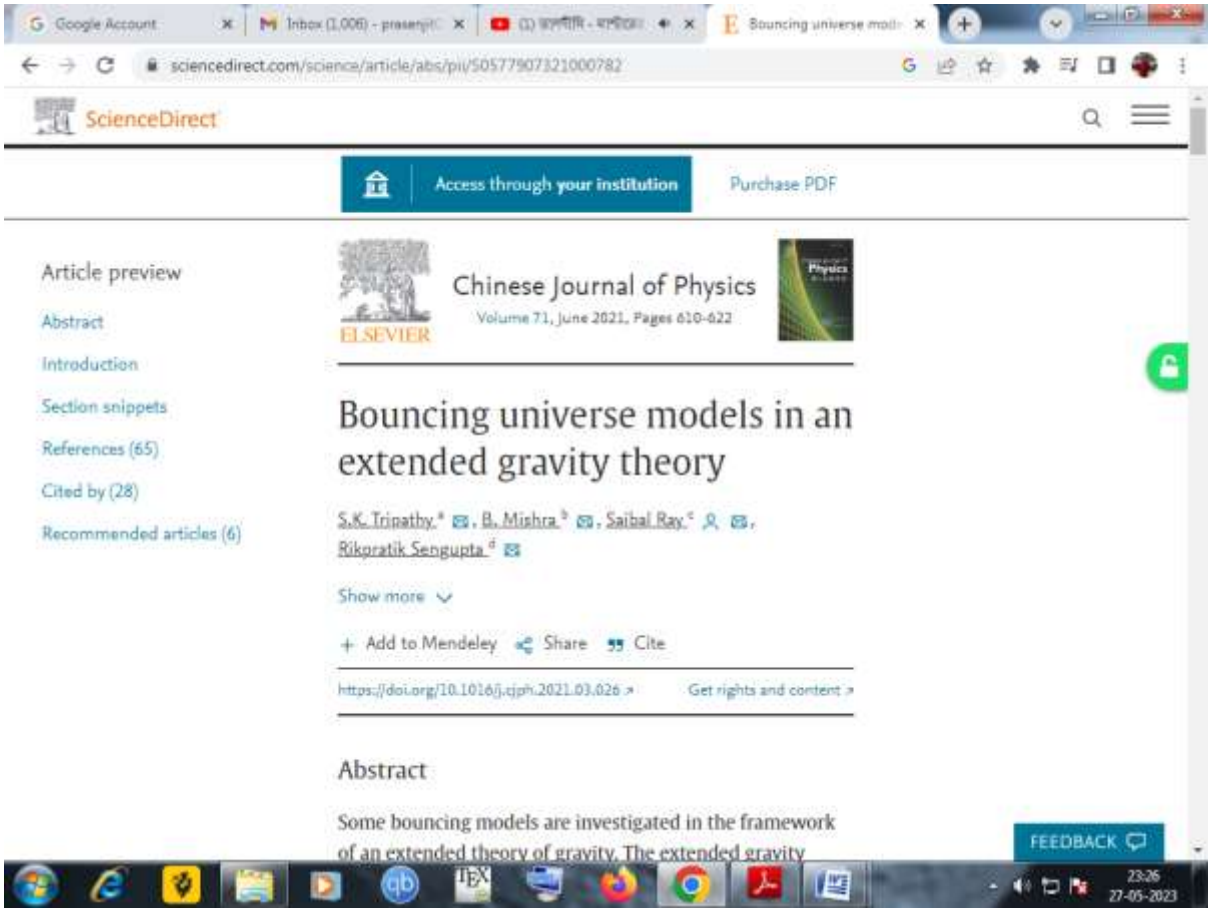
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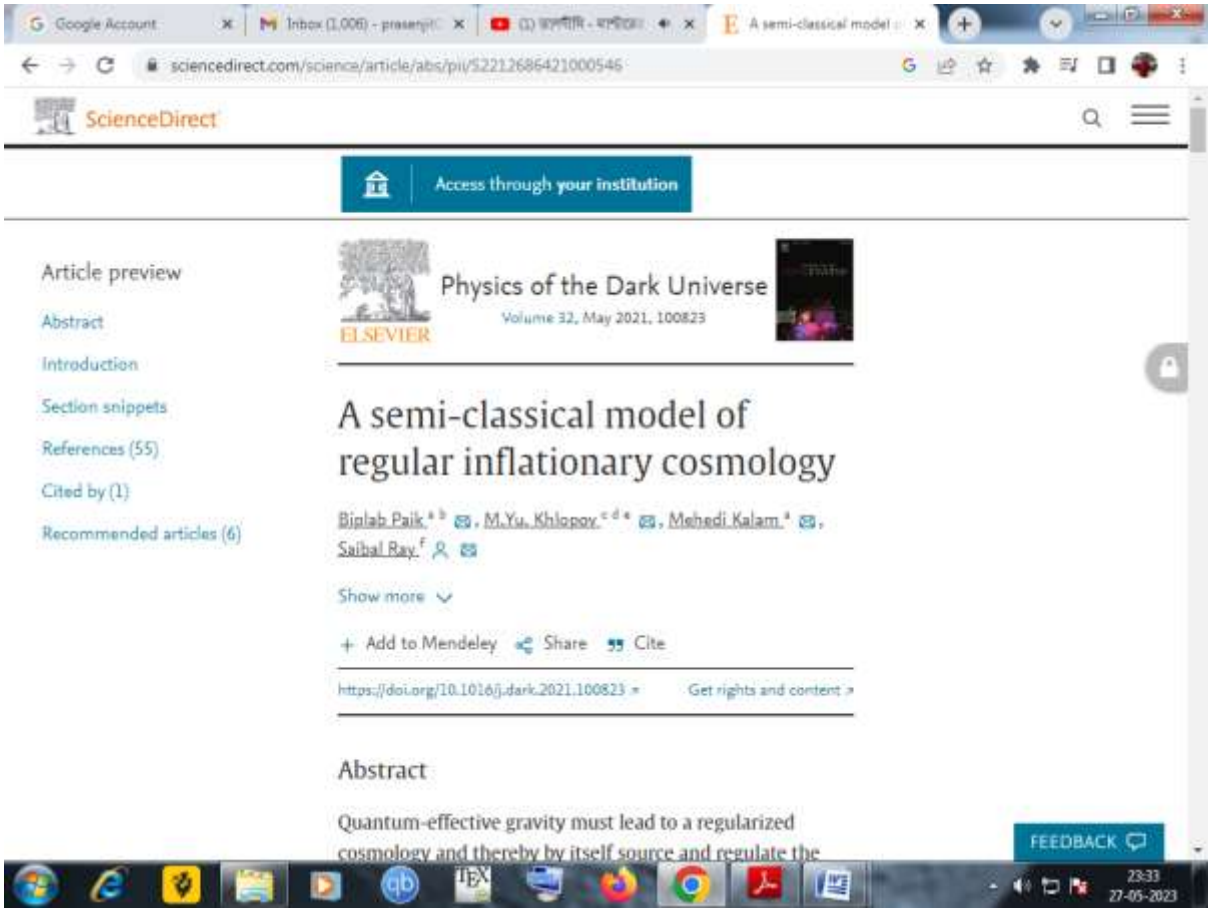
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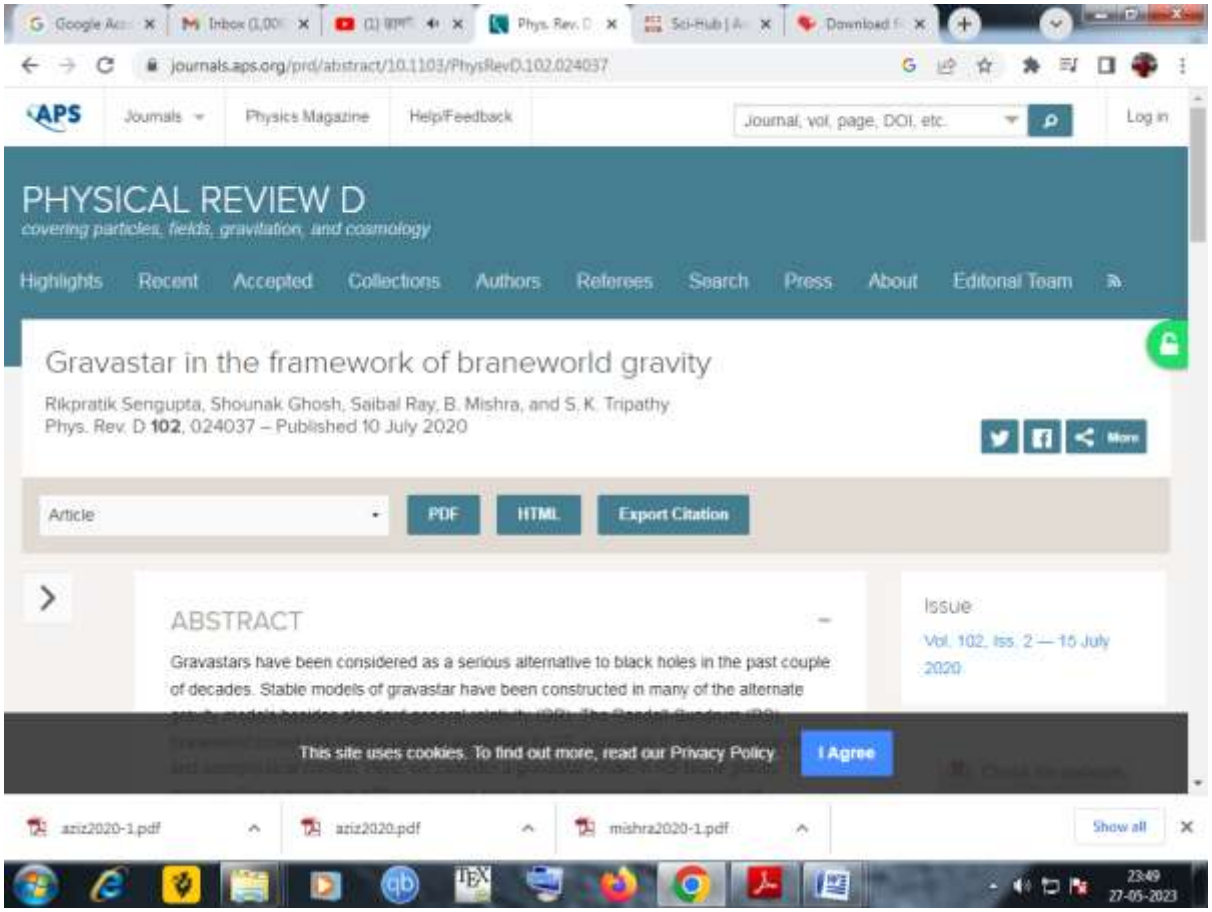
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ABSTRACT
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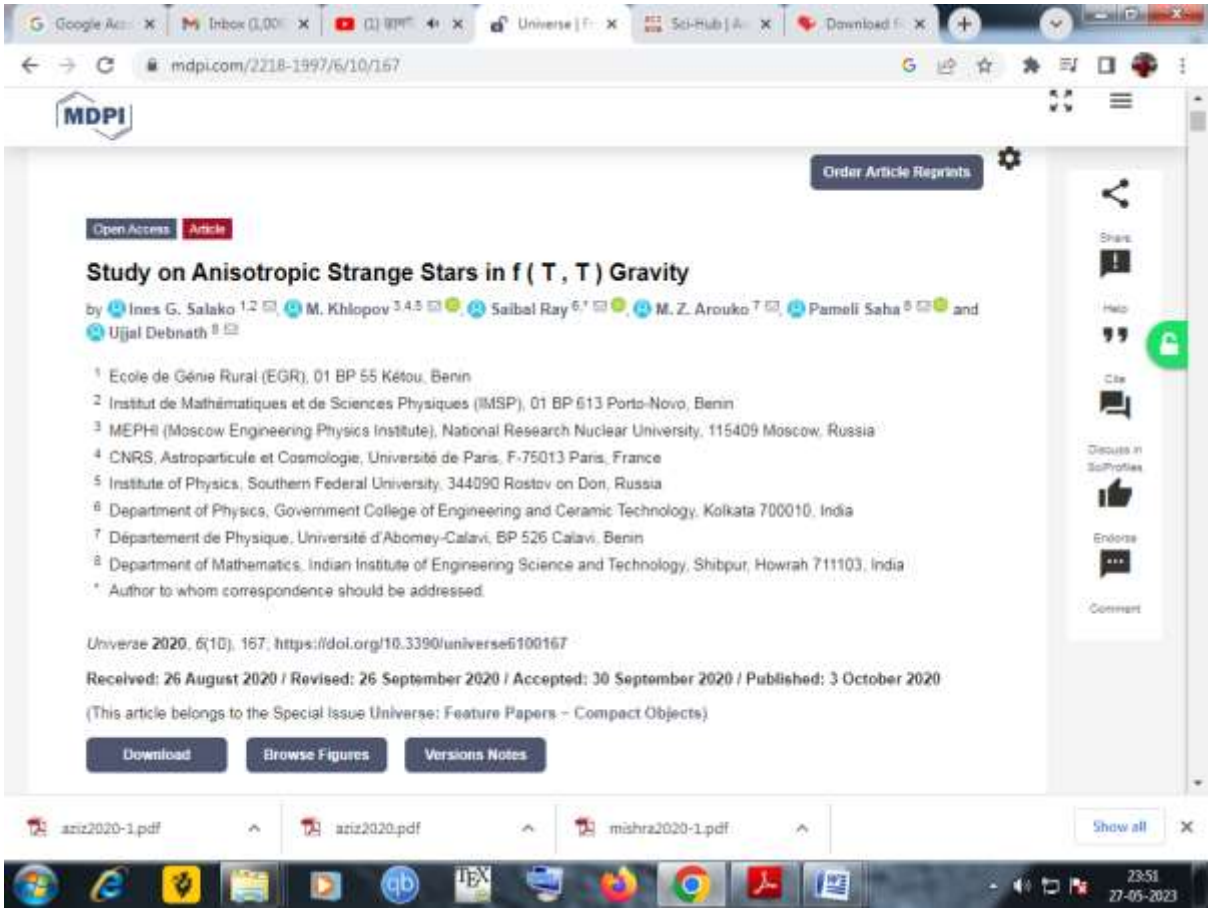
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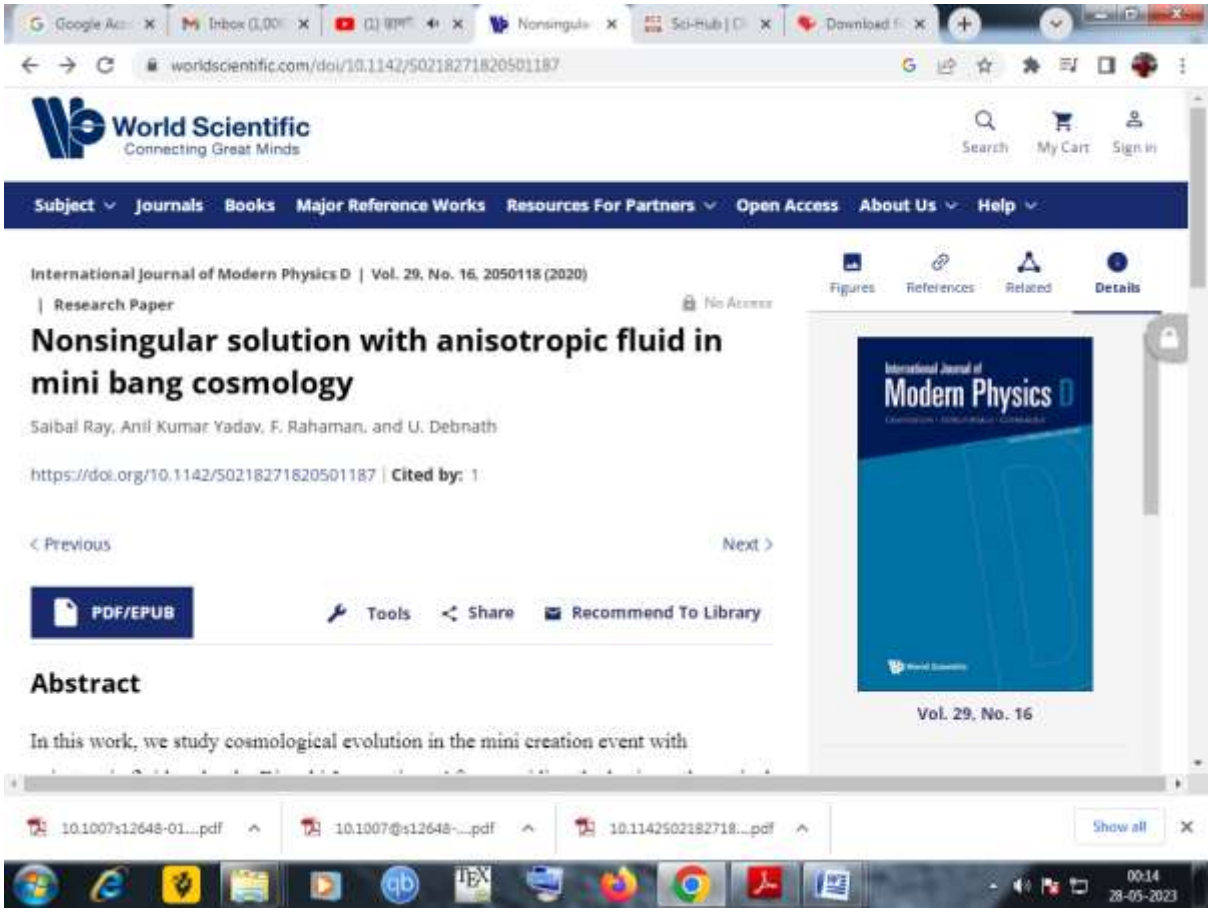
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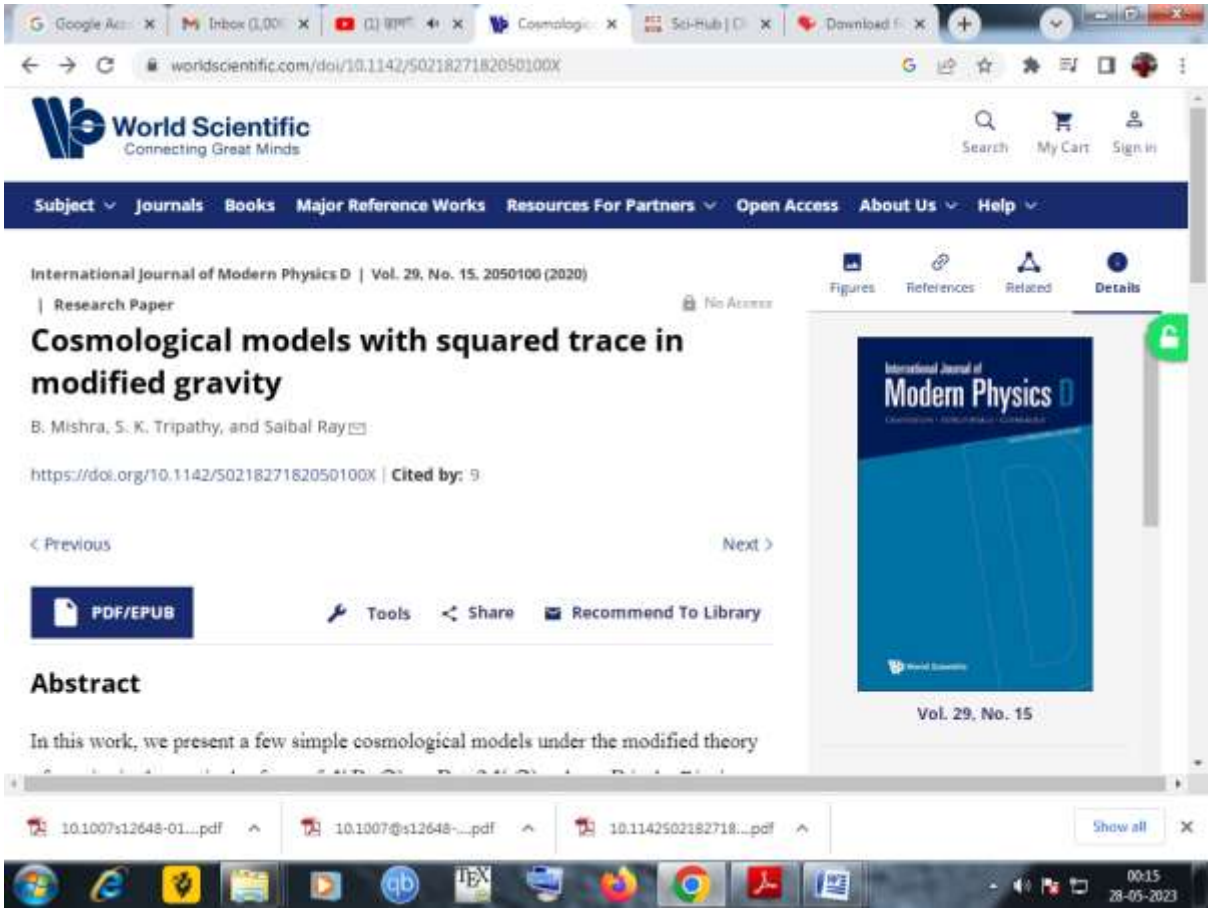
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Sadhana (2021) 46:116
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Digitized data validation using dual color images with improved robustness and error correction facility

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Abstract. The proposed algorithm takes an initiative to justify strong ownership claims by blending visual cryptography with steganography, which is quite different from a conventional approach. The major consideration of the proposed protocol is to implement cryptographic technique in digitized document justifying Confidentiality, Integrity, Authenticity and Non-Repudiation, similar to cryptographic technique implementation in born digital document. In addition, the approach is less complex than a conventional system but without compromising the level of security. For the protection of a sensitive or copyright document, the owner cleans the digitized signature, generate two shares and fabricate one of the shares alongside the encrypted message digest of the signature in the pseudorandom positions of coiflet transformed blocks. Instead of using a single plane as cover, three planes of two color images are utilized to enhance the effect of robustness in hiding. The secret fabrication in frequency domain preserves excellent security as well as imperceptibility of the hidden data. The loss of signal due to white noise is properly adjusted to make the authenticated images resemble close to the original ones as depicted with the histogram and RGB analysis. Moreover, an intended receiver only will be able to verify the confidentiality of the document and the owner through self-defined appropriate techniques. Finally, the worthiness of the algorithm in digitized domain is established through exhaustive experimentation in terms of data hiding imperceptibility, robustness and data recovery aspects.

Keywords. Visual cryptography; share generation; hamming code; key exchange; image compression; SSIM.

1. Introduction

The modern era of digital communication highly demands sustainability of authenticity and non-repudiation properties of data security. The problem of information hacking was somewhat resisted using watermarking and when used in digital data authentication [1, 2] applies to low risk transmission. In addition, steganography can cater un-detectability, resistance to various image processing methods, compression and capacity of the secret data categorically. So, watermarking and steganography [3–5] concepts combined can protect secured digital documents.

In covert communication, only intended authorized receiver should confirm ownership of content [6, 7]. User authentication was first proposed by A. Shamir [8] with the help of private and public shares. So, the advantage of reframing correct data in share based digital data authentication can be quite handy in protecting secured data. Generally, data authentication protocols are implemented either in spatial or frequency domain. Due to efficient performance and wide popularity of Discrete Cosine Transform (DCT) domain, Cox *et al* [9] suggested that DCT can be used extensively in Joint Photographic Experts Group (JPEG) compression procedure. In addition, Koch *et al* [10] suggested the use of middle band frequency coefficients of a DCT transformed block for sensitive data fabrication to resist JPEG compression. But the problem of blocking artifacts was somewhat eliminated by wavelet transform [11] which shows superiority during transmission and decoding errors.

In the context of using wavelet transform in digital data authentication, Garima Chopra *et al* [12] proposed Geometric wavelet in image coding method and the performance is improved in comparison to embedded zero-tree wavelet (EZW), the set partitioning in hierarchical trees (SPIHT) and the embedded block coding with optimized

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Applied Ceramic TECHNOLOGY

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A novel approach toward microstructure evaluation of sintered ceramic materials through image processing techniques

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Department of Science and Technology and Biotechnology, Govt. of West Bengal, Grant/Award Number: 10 (Sanc.)-ST/P/S&T/6G-4/2018

Abstract

In this paper, an image processing technique is introduced to measure the grain size and their distributions from the SEM image of copper oxide (CuO) and titanium dioxide (TiO_2) doped sintered alumina ceramics accurately. The noise present in SEM image is removed by applying low pass Gaussian filter followed by suppression of regional minima over a threshold. The clarity of individual grains and grain boundaries have been done by applying Watershed transform to this preprocessed SEM image. Morphological operations like dilation and erosion are used to make the grain-boundary edges clear and continuous. The individual grain size in μm scale is measured from the pixel length of the rectangular bounding box drawn around the segmented grain. The normal Gaussian type distribution of grain size is observed in both CuO- and TiO_2-doped grains in SEM image. The average grain size of CuO-doped alumina grains (2.24 μm) is very close to G_{50} value (2.17 μm), but G_{50} value of TiO_2-doped grains (8.59 μm) is slightly higher than its average grain size (7.96 μm). The proposed algorithm is compared with linear intercept method and the grain sizes obtained are very close to each other.

KEYWORDS

alumina, doping, grain size, image processing, scanning electron microscopy

1 | INTRODUCTION

The present research in material science and engineering are inclined toward interdisciplinary areas and in these aspect different tools of computer science plays an essential role to evaluate and explain the material properties more accurately. Therefore, emerging research work focuses to frame an accurate and automated feature analysis of the properties of engineering materials.[1] Scanning electron microscopic (SEM) image is the acquisition of useful signal produced by the interactions between electron beams and surface electrons of the specimen. SEM image consists of grains of different phases, grain morphology, surface texture, pores, and inclusion in the microstructure.[2] The single oxide polycrystalline ceramics generally shows grain growth in an irregular manner. The dopant materials inhibit this abnormal grain growth which is characterized by nontextured grains of tetrakaidecahedral shape having log-normal size distribution. The average grain size is based on near to spherical geometry with not so much wide size distribution.[3,4] These can be studied in-depth with the help of digital image processing technology.[5–7] The properties of engineering materials are related to the variation in grain size, size distribution, and pores present in the microstructure. The microstructures are also controlled by different process parameters like sintering temperature, soaking time, the effect of foreign inclusion, nature and concentration of doping, etc.[8,9] In this context the microstructure related studies based on different computing techniques such as fuzzy logic, neural network, and statistical image analysis should be highlighted. Dutta et al.[10] have studied tensile fractography of AISI 304LN austenitic stainless steel to detect and characterize

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ORIGINAL ARTICLE

Applied Ceramic TECHNOLOGY

Effect of nano CuO addition on the tribo-mechanical behavior of alumina ceramics in non-conformal contact

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Abstract

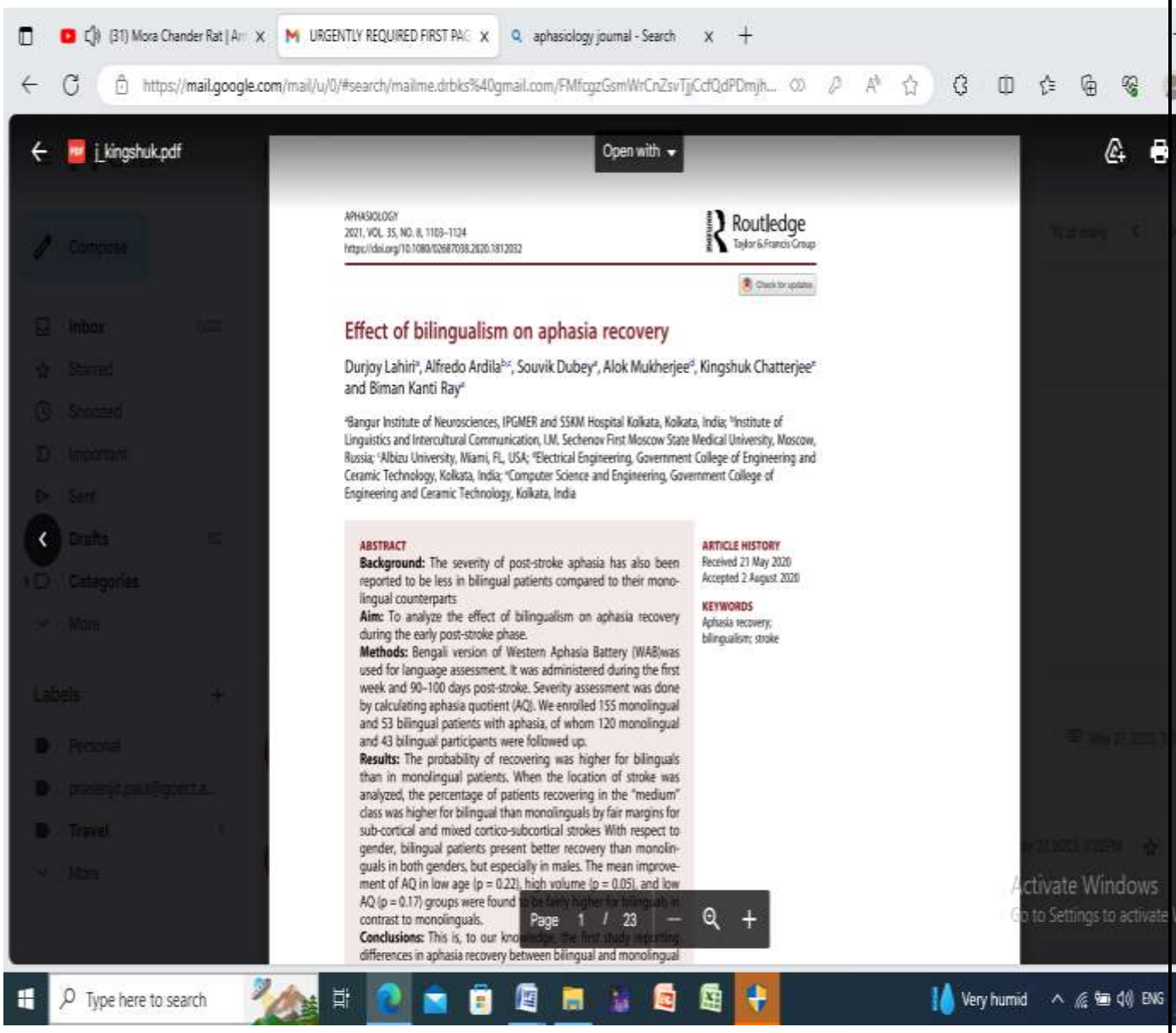
Sintering of alumina from 1500°C to 1650°C and tribo-mechanical properties at room temperature had been investigated using nano CuO as a sintering aid. Bulk density gradually increases with sintering temperature from 1500°C to 1600°C and is optimized at 1600°C, beyond this, bulk density does not significantly increase at 1650°C. The addition of 2 wt% CuO showed the best result on densification. Densification of about 97.74% was attained at 1600°C with the incorporation of 2 wt% CuO. Nano CuO at grain boundaries forms $CuAl_2O_4$ liquid which modifies the morphology of the grain and improves mechanical properties. The formation of self-lubricating tribo-film on the wear track results in a low coefficient of friction <0.2 and reduces specific wear rate. 4 wt% CuO addition increases contact tensile stress (σ_{max}) by 51.2% and high Hertzian contact pressure ($P_{max} \approx 1.51$ GPa) causes plastic deformation of wear track. The re-solidified strengthening bond phase on the wear track simultaneously increases in friction coefficient and wear resistance with CuO addition. The optimizing effect of CuO addition shows that 2 wt% significantly decreases wear rate, and increases hardness and fracture toughness.

KEYWORDS

Al_2O_3, mechanical properties, sintering, wear resistance

1 | INTRODUCTION

The well-known alumina ceramics have extensive structural application due to its outstanding physico-mechanical properties like hardness, wear resistance, good thermal conductivity, and thermal and chemical stability even at high temperature.[1] Its typical application includes in various engineering fields such as laser tubes, cutting tools, wear pads, high temperature electrical insulators, electronic substrates, automobiles, especially in unlubricated engines, aerospace, and even in biomaterials.[2-7] However, the fracture toughness of alumina ceramics is low, as a result, the material becomes brittle and thus its application reduces. Numerous research has been carried out to improve tribological behavior in conformal contact by incorporation of oxides like CuO, Y_2O_3, ZrO_2, MgO, TiO_2, Nb_2O_3[8-12] and nonoxides like SiC, TiN, TiB_2,CNT[13] etc as a secondary phase in alumina matrix. Valefi et al[14] investigated the effect of CuO addition into yttria stabilized tetragonal zirconia polycrystalline (Y-TZP) ceramics sliding against alumina ball in conformal contact. They reported that the coefficient of friction (COF) reduces to 0.35 with a low wear rate ($<10^{-6}$ m^3/N m) due to accumulation of soft copper oxide layer which causes shifting of the wear mechanism from brittle to ductile and increases wear resistance. The effect of different lubricating additives like TiC, CNT, CaF_2 etc to improve tribological attributes of alumina and alumina-zirconia composite up to a certain level of addition and range of temperature by reinforcement in the matrix was also reported by several researchers.[15-18] Counter-surface plays an essential role on COF Kerkwijk et al[10] have reported that COF changes from 0.65 to 0.43 when Al_2O_3 ball is replaced by Y-TZP ball as a counter surface on 5 wt.% CuO added alumina sintered. The tribo-mechanical properties of CuO/3Y-TZP composite system sliding upon Al_2O_3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APHASIOLOGY
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Effect of bilingualism on aphasia recovery
Durjoy Lahiri[a], Alfredo Ardila[b,c], Souvik Dubey[a], Alok Mukherjee[d], Kingshuk Chatterjee[e] and Biman Kanti Ray[a]
[a]Bangur Institute of Neurosciences, IPGMER and SSKM Hospital Kolkata, Kolkata, India; [b]Institute of Linguistics and Intercultural Communication, I.M. Sechenov First Moscow State Medical University, Moscow, Russia; [c]Albizu University, Miami, FL, USA; [d]Electrical Engineering, Government College of Engineering and Ceramic Technology, Kolkata, India; [e]Computer Science and Engineering, Government College of Engineering and Ceramic Technology, Kolkata, India
ABSTRACT
Background: The severity of post-stroke aphasia has also been reported to be less in bilingual patients compared to their monolingual counterparts
Aim: To analyze the effect of bilingualism on aphasia recovery during the early post-stroke phase.
Methods: Bengali version of Western Aphasia Battery (WAB)was used for language assessment. It was administered during the first week and 90–100 days post-stroke. Severity assessment was done by calculating aphasia quotient (AQ). We enrolled 155 monolingual and 53 bilingual patients with aphasia, of whom 120 monolingual and 43 bilingual participants were followed up.
Results: The probability of recovering was higher for bilinguals than in monolingual patients. When the location of stroke was analyzed, the percentage of patients recovering in the "medium" class was higher for bilingual than monolinguals by fair margins for sub-cortical and mixed cortico-subcortical strokes With respect to gender, bilingual patients present better recovery than monolinguals in both genders, but especially in males. The mean improvement of AQ in low age (p = 0.22), high volume (p = 0.05), and low AQ (p = 0.17) groups were found to be fairly higher for bilinguals in contrast to monolinguals.
Conclusions: This is, to our knowledge, the first study reporting differences in aphasia recovery between bilingual and monolingual
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KEYWORDS
Aphasia recovery; bilingualism; stroke
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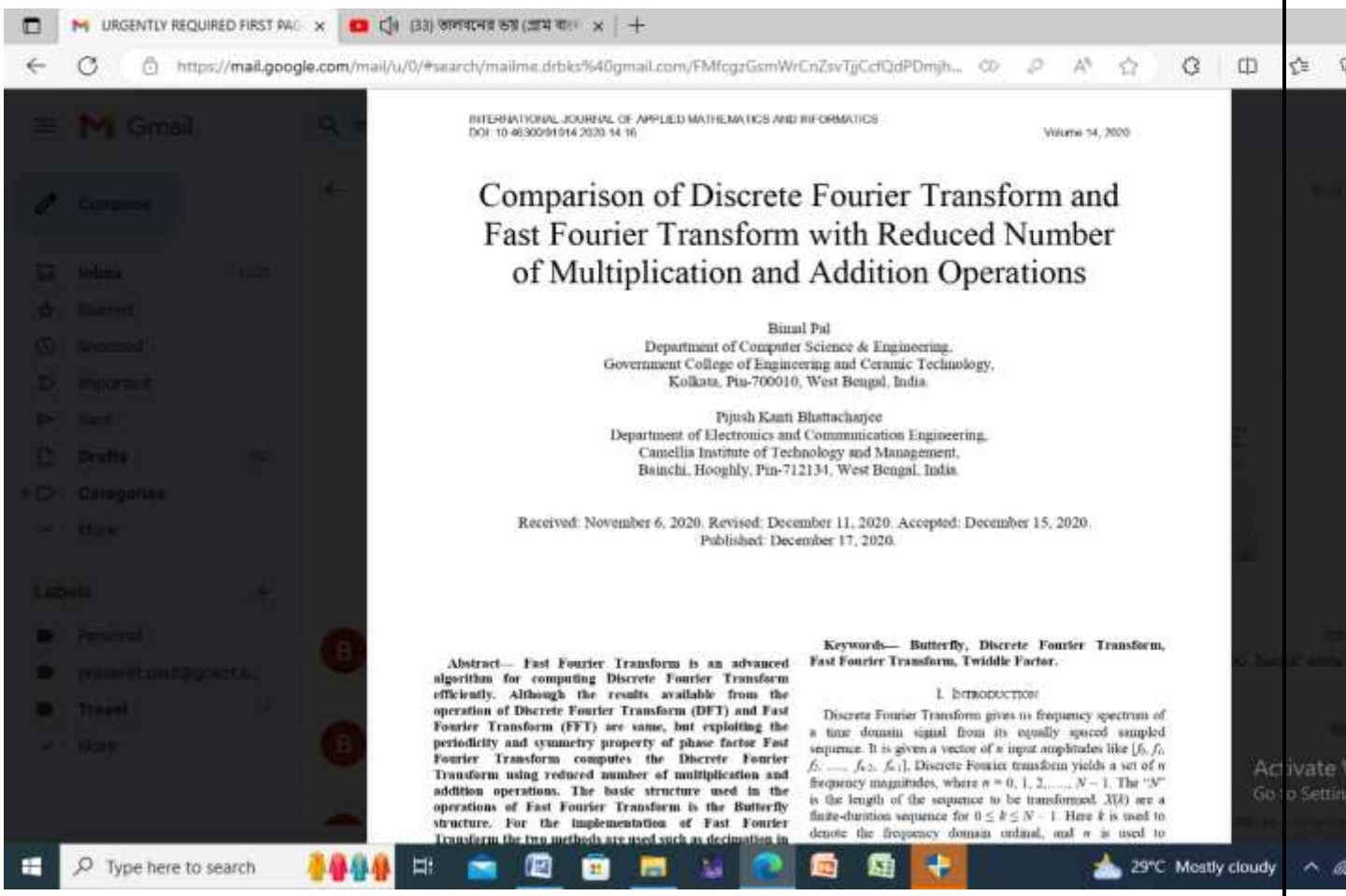

INTERNATIONAL JOURNAL OF APPLIED MATHEMATICS AND INFORMATICS
DOI: 10.46300/91914.2020.14.16 Volume 14, 2020

Comparison of Discrete Fourier Transform and Fast Fourier Transform with Reduced Number of Multiplication and Addition Operations

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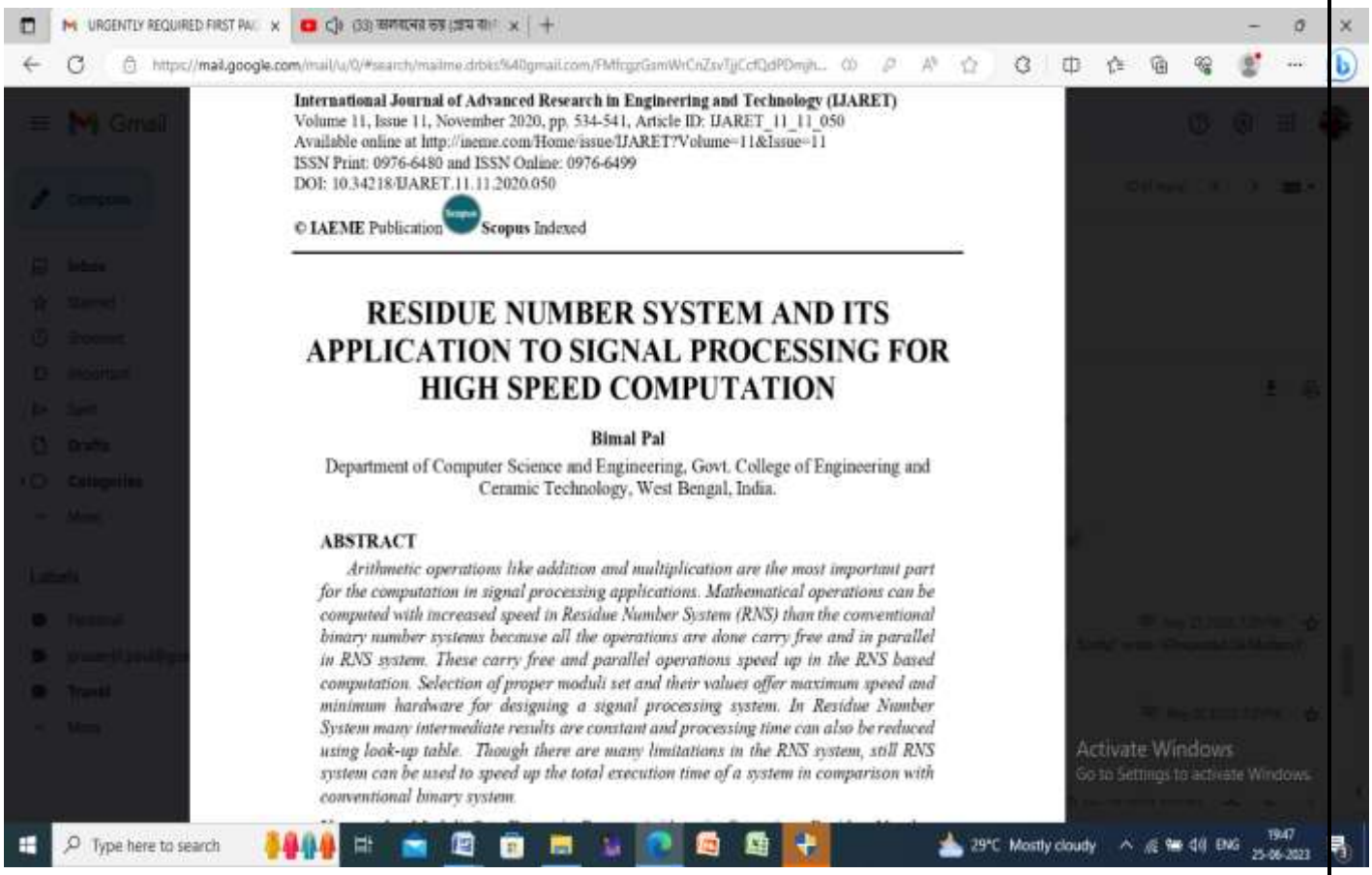
Published: December 17, 2020.

Abstract— Fast Fourier Transform is an advanced algorithm for computing Discrete Fourier Transform efficiently. Although the results available from the operation of Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) are same, but exploiting the periodicity and symmetry property of phase factor Fast Fourier Transform computes the Discrete Fourier Transform using reduced number of multiplication and addition operations. The basic structure used in the operations of Fast Fourier Transform is the Butterfly structure. For the implementation of Fast Fourier Transform the two methods are used such as decimation in

Keywords— Butterfly, Discrete Fourier Transform, Fast Fourier Transform, Twiddle Factor.

I. Introduction

Discrete Fourier Transform gives us frequency spectrum of a time domain signal from its equally spaced sampled sequence. It is given a vector of n input amplitudes like $[f_0, f_1, f_2, \ldots, f_{n-2}, f_{n-1}]$, Discrete Fourier transform yields a set of n frequency magnitudes, where $n = 0, 1, 2, \ldots, N-1$. The "N" is the length of the sequence to be transformed. $X(k)$ are a finite-duration sequence for $0 \le k \le N-1$. Here k is used to denote the frequency domain ordinal, and n is used to



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DOI: 10.34218/IJARET.11.11.2020.050

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RESIDUE NUMBER SYSTEM AND ITS APPLICATION TO SIGNAL PROCESSING FOR HIGH SPEED COMPUTATION

Bimal Pal
Department of Computer Science and Engineering, Govt. College of Engineering and Ceramic Technology, West Bengal, India.

ABSTRACT

Arithmetic operations like addition and multiplication are the most important part for the computation in signal processing applications. Mathematical operations can be computed with increased speed in Residue Number System (RNS) than the conventional binary number systems because all the operations are done carry free and in parallel in RNS system. These carry free and parallel operations speed up in the RNS based computation. Selection of proper moduli set and their values offer maximum speed and minimum hardware for designing a signal processing system. In Residue Number System many intermediate results are constant and processing time can also be reduced using look-up table. Though there are many limitations in the RNS system, still RNS system can be used to speed up the total execution time of a system in comparison with conventional binary system.

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Research Article

Fabrication and Performance Evaluation of Industrial Alumina Based Graded Ceramic Substrate for CO_2 Selective Amino Silicate Membrane

Savan Kumar Sharma, Barun K. Sanfui,* Aviti Katare, and Bishnupada Mandal*

Cite This: ACS Appl. Mater. Interfaces 2020, 12, 40269−40284

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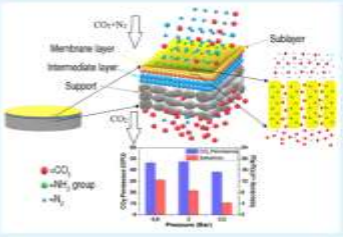
ABSTRACT: The present study mainly focuses on the careful design of an amino-silicate membrane integrated on an asymmetric graded membrane substrate, comprised of a cost-effective macro-porous industrial alumina based ceramic support with a systematic graded assemblage of sol−gel derived γ-alumina intermediate and silica-CTAB sublayer-based multilayered interface, specifically dedicated for the separation of CO_2 gas from the binary gas mixture (CO_2/N_2) under nearly identical flue gas atmospheric conditions. The tailor-made industrial α-alumina-based porous ceramic support has been characterized in terms of apparent porosity, bulk density, flexural strength, microstructural feature, pore size, and its distribution to demonstrate its application feasibility toward the evolution of the subsequent membrane structure. The near surface morphology of the subsequent intermediate and submembrane layer has been carefully controlled via precisely scheming the colloidal chemistry and consequently implementing it during the deposition process of the respective γ-alumina and silica-CTAB precursor sols, whereas the potentiality of the quarantined amine groups in the final amino-silicate



J. Inst. Eng. India Ser. B (August 2020) 101(4):321–333
https://doi.org/10.1007/s40031-020-00466-5

ORIGINAL CONTRIBUTION

Application of Principal Component Analysis for Fault Classification in Transmission Line with Ratio-Based Method and Probabilistic Neural Network: A Comparative Analysis

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 4 June 2019 / Accepted: 2 July 2020 / Published online: 17 July 2020

Abstract The proposed work illustrates a simple research approach to identify the type of fault in a three-phase overhead single-end-fed long transmission line. Multivariate statistical methods like principal component analysis (PCA) alone, and in combination with probabilistic neural network (PNN), have been applied here to classify fault. An attempt has been made to use the PCA features obtained from the analysis of electrical parameters for each of the faults, in two ways. The first approach of fault classification is based on analyzing the PCA features by a modified ratio-based analysis. In the second method, an attempt has been made to use the PCA features directly to a

Keywords Principal component analysis (PCA) · Probabilistic neural network (PNN) · Principal component scores (PCS) · Principal component indices (PCI) · Modified principal component indices (PCIM) · Ratio method

Introduction

Power transmission system, being one of the most expanded overhead networks, is often subjected to various tran-

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Effect of bilingualism on aphasia recovery

Durjoy Lahiri[a], Alfredo Ardila[b,c], Souvik Dubey[a], Alok Mukherjee[d], Kingshuk Chatterjee[e] and Biman Kanti Ray[a]

[a]Bangur Institute of Neurosciences, IPGMER and SSKM Hospital Kolkata, Kolkata, India; [b]Institute of Linguistics and Intercultural Communication, I.M. Sechenov First Moscow State Medical University, Moscow, Russia; [c]Albizu University, Miami, FL, USA; [d]Electrical Engineering, Government College of Engineering and Ceramic Technology, Kolkata, India; [e]Computer Science and Engineering, Government College of Engineering and Ceramic Technology, Kolkata, India

ABSTRACT

Background: The severity of post-stroke aphasia has also been reported to be less in bilingual patients compared to their monolingual counterparts

Aim: To analyze the effect of bilingualism on aphasia recovery during the early post-stroke phase.

Methods: Bengali version of Western Aphasia Battery (WAB)was used for language assessment. It was administered during the first week and 90–100 days post-stroke. Severity assessment was done by calculating aphasia quotient (AQ). We enrolled 155 monolingual and 53 bilingual patients with aphasia, of whom 120 monolingual and 43 bilingual participants were followed up.

Results: The probability of recovering was higher for bilinguals than in monolingual patients. When the location of stroke was analyzed, the percentage of patients recovering in the "medium" class was higher for bilingual than monolinguals by fair margins for sub-cortical and mixed cortico-subcortical strokes With respect to gender, bilingual patients present better recovery than monolinguals in both genders, but especially in males. The mean improvement of AQ in low age ($p = 0.22$), high volume ($p = 0.05$), and low AQ ($p = 0.17$) groups were found to be fairly higher for bilinguals in contrast to monolinguals.

Conclusions: This is, to our knowledge, the first study reporting

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KEYWORDS
Aphasia recovery; bilingualism; stroke

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https://doi.org/10.1007/s40031-020-00515-z

ORIGINAL CONTRIBUTION

Transmission Line Fault Location Using PCA-Based Best-Fit Curve Analysis

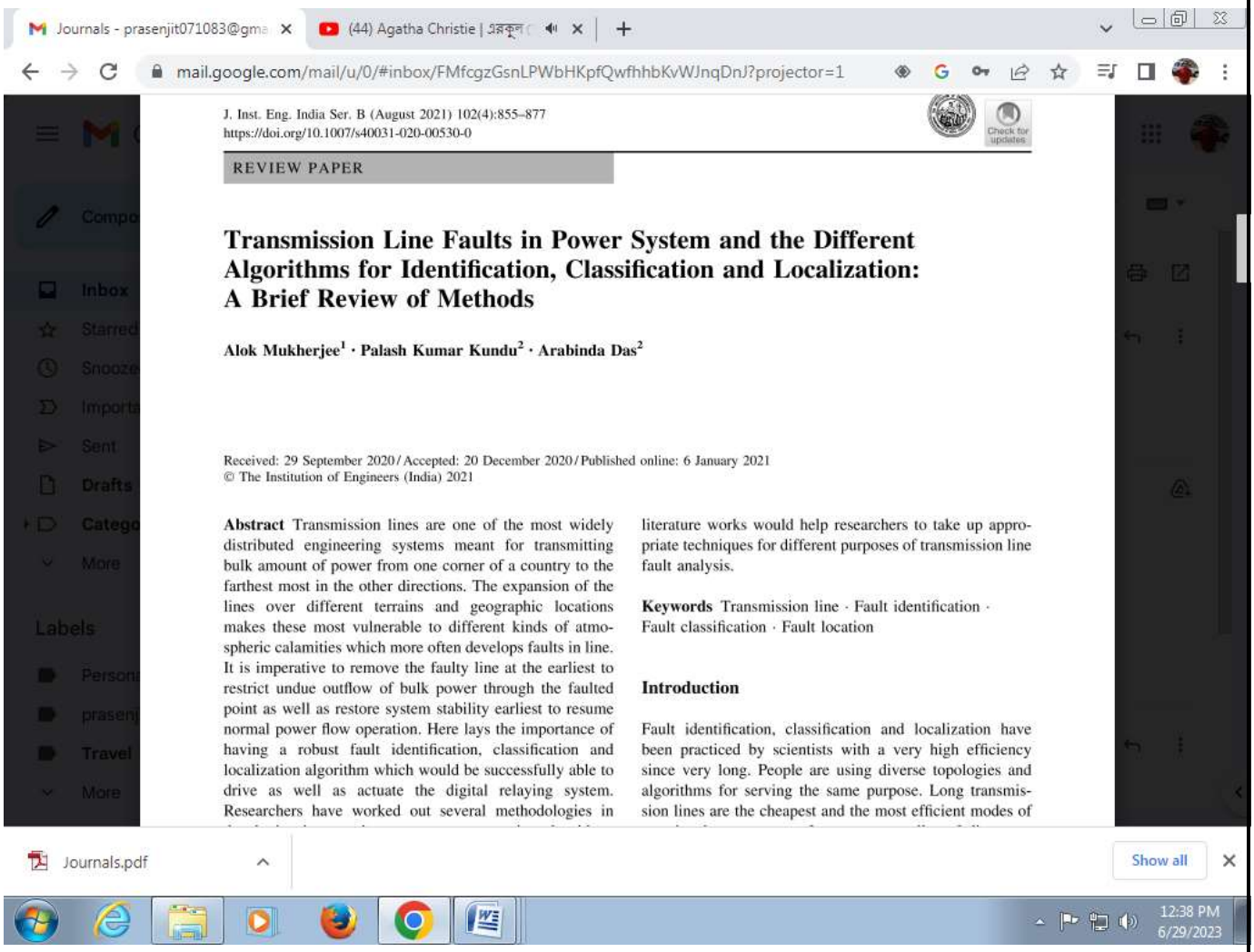
Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 28 May 2020 / Accepted: 29 October 2020 / Published online: 17 November 2020

Abstract The paper presents a principal component analysis (PCA)-based method for localization of various power system faults in a 150 km long single side fed transmission line using quarter-cycle pre-fault and half-cycle post-fault sending end line current signals. The proposed work uses fault signals of ten different types of seven intermediate locations along the length of the line to develop three-phase PCA score indices. The localizer model is also designed for practical fitment, with fault signals contaminated with power system noise. These seven sets of indices are further used with the best-fit curve fitting method in the MATLAB environment to develop fault curves. Minimum root mean square error criteria are followed for selecting the fit type.

Introduction

Fault classification and localization is one of the most frequently researched topics of power system stability and reliability. Large power transmission networks expand over miles under the sky and often are exposed to different atmospheric hazards like storm, snow, rain and many others. These cause minor to severe faults in the transmission lines. Relays and other detection devices provide live fault data regarding voltage, current, frequency, power factor, etc. to different protection algorithms to extract vital fault information. The objective of the proposed work is to develop a robust protection scheme to localize fault, in



J. Inst. Eng. India Ser. B (August 2021) 102(4):855–877
https://doi.org/10.1007/s40031-020-00530-0

REVIEW PAPER

Transmission Line Faults in Power System and the Different Algorithms for Identification, Classification and Localization: A Brief Review of Methods

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

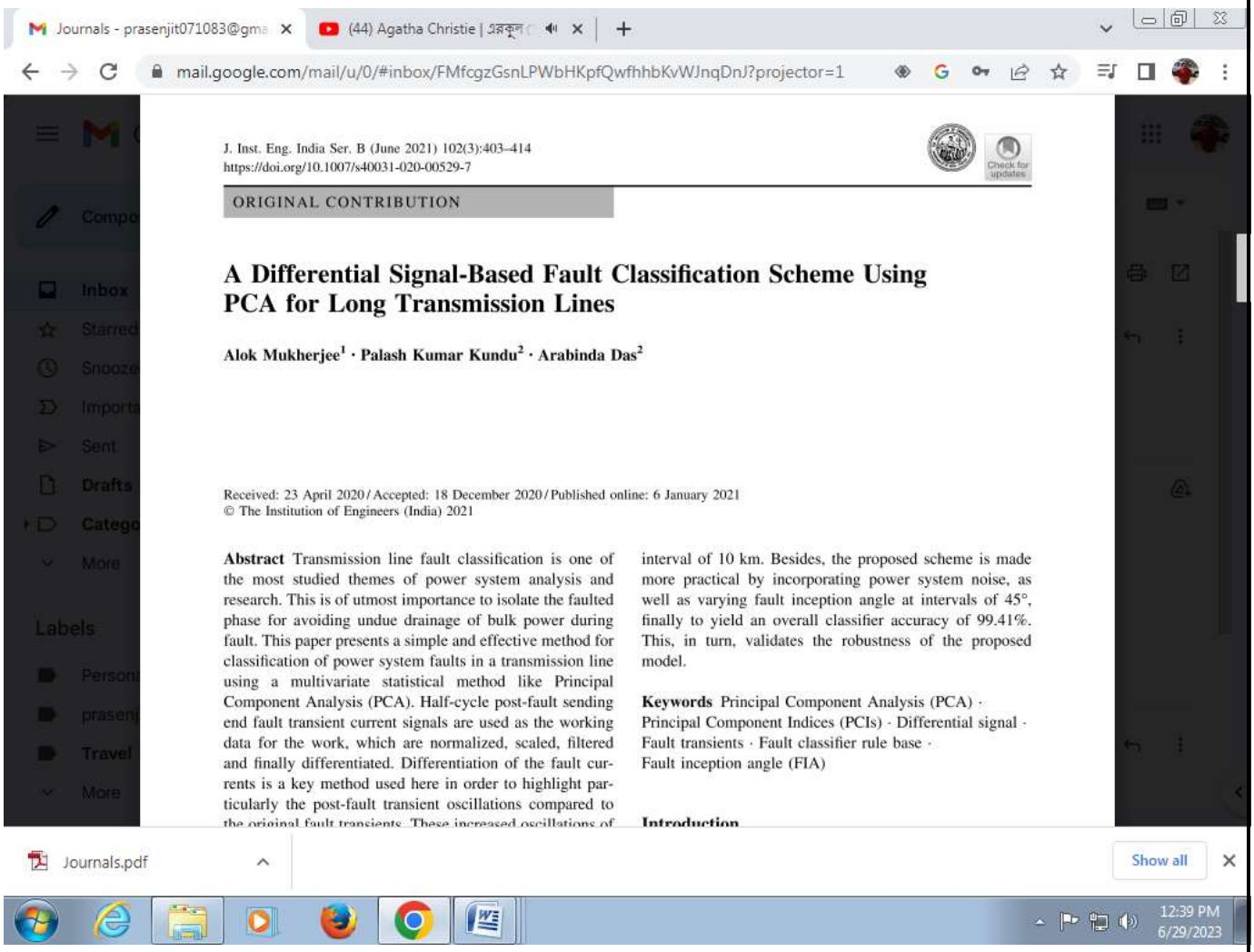
Received: 29 September 2020 / Accepted: 20 December 2020 / Published online: 6 January 2021

Abstract Transmission lines are one of the most widely distributed engineering systems meant for transmitting bulk amount of power from one corner of a country to the farthest most in the other directions. The expansion of the lines over different terrains and geographic locations makes these most vulnerable to different kinds of atmospheric calamities which more often develops faults in line. It is imperative to remove the faulty line at the earliest to restrict undue outflow of bulk power through the faulted point as well as restore system stability earliest to resume normal power flow operation. Here lays the importance of having a robust fault identification, classification and localization algorithm which would be successfully able to drive as well as actuate the digital relaying system. Researchers have worked out several methodologies in literature works would help researchers to take up appropriate techniques for different purposes of transmission line fault analysis.

Keywords Transmission line · Fault identification · Fault classification · Fault location

Introduction

Fault identification, classification and localization have been practiced by scientists with a very high efficiency since very long. People are using diverse topologies and algorithms for serving the same purpose. Long transmission lines are the cheapest and the most efficient modes of



J. Inst. Eng. India Ser. B (June 2021) 102(3):403–414
https://doi.org/10.1007/s40031-020-00529-7

ORIGINAL CONTRIBUTION

A Differential Signal-Based Fault Classification Scheme Using PCA for Long Transmission Lines

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 23 April 2020 / Accepted: 18 December 2020 / Published online: 6 January 2021

Abstract Transmission line fault classification is one of the most studied themes of power system analysis and research. This is of utmost importance to isolate the faulted phase for avoiding undue drainage of bulk power during fault. This paper presents a simple and effective method for classification of power system faults in a transmission line using a multivariate statistical method like Principal Component Analysis (PCA). Half-cycle post-fault sending end fault transient current signals are used as the working data for the work, which are normalized, scaled, filtered and finally differentiated. Differentiation of the fault currents is a key method used here in order to highlight particularly the post-fault transient oscillations compared to the original fault transients. These increased oscillations of interval of 10 km. Besides, the proposed scheme is made more practical by incorporating power system noise, as well as varying fault inception angle at intervals of 45°, finally to yield an overall classifier accuracy of 99.41%. This, in turn, validates the robustness of the proposed model.

Keywords Principal Component Analysis (PCA) · Principal Component Indices (PCIs) · Differential signal · Fault transients · Fault classifier rule base · Fault inception angle (FIA)

Introduction

J. Inst. Eng. India Ser. B (August 2021) 102(4):655–670
https://doi.org/10.1007/s40031-020-00526-w

ORIGINAL CONTRIBUTION

Classification and Fast Detection of Transmission Line Faults Using Signal Entropy

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 8 July 2020 / Accepted: 3 December 2020 / Published online: 18 January 2021

Abstract A simple, prompt and accurate method of fault identification and classification of faults in a long transmission system is presented here using entropy analysis of post-fault three-phase current signals, measured at the sending end only. Identification of the faulted phase is imperative for restricting unwanted outage of power through the faulted phase, as well as isolation of the same in order to retain the stability of the system. Transmission line fault classification, hence, has become one of the most vital topics of research. The high-frequency transient current oscillations, appearing immediately after the fault, are analyzed in this work. Signal entropy is computed for the modified waveform of each phase using the differentiation of fault using the estimated signal entropy values, thereby aiding in the development of a threshold-based fault classifier entropy signatures. The major findings of the present work are primarily twofold: 100% accuracy of classification and requirement of only (1/20)th of post-fault signal, that is, detection within 1 ms, which is commendably fast compared to several contemporary works. Besides, the variation of fault parameters, such as fault location, fault resistance and power line noise, makes the design more practically suited.

Keywords Signal entropy · Entropy window · Differential signal · Fault resistance · Fault classification

Electrical Engineering (2021) 103:2113–2126
https://doi.org/10.1007/s00202-021-01221-9

ORIGINAL PAPER

A supervised principal component analysis-based approach of fault localization in transmission lines for single line to ground faults

Alok Mukherjee[1] · Palash K. Kundu[2] · Arabinda Das[2]

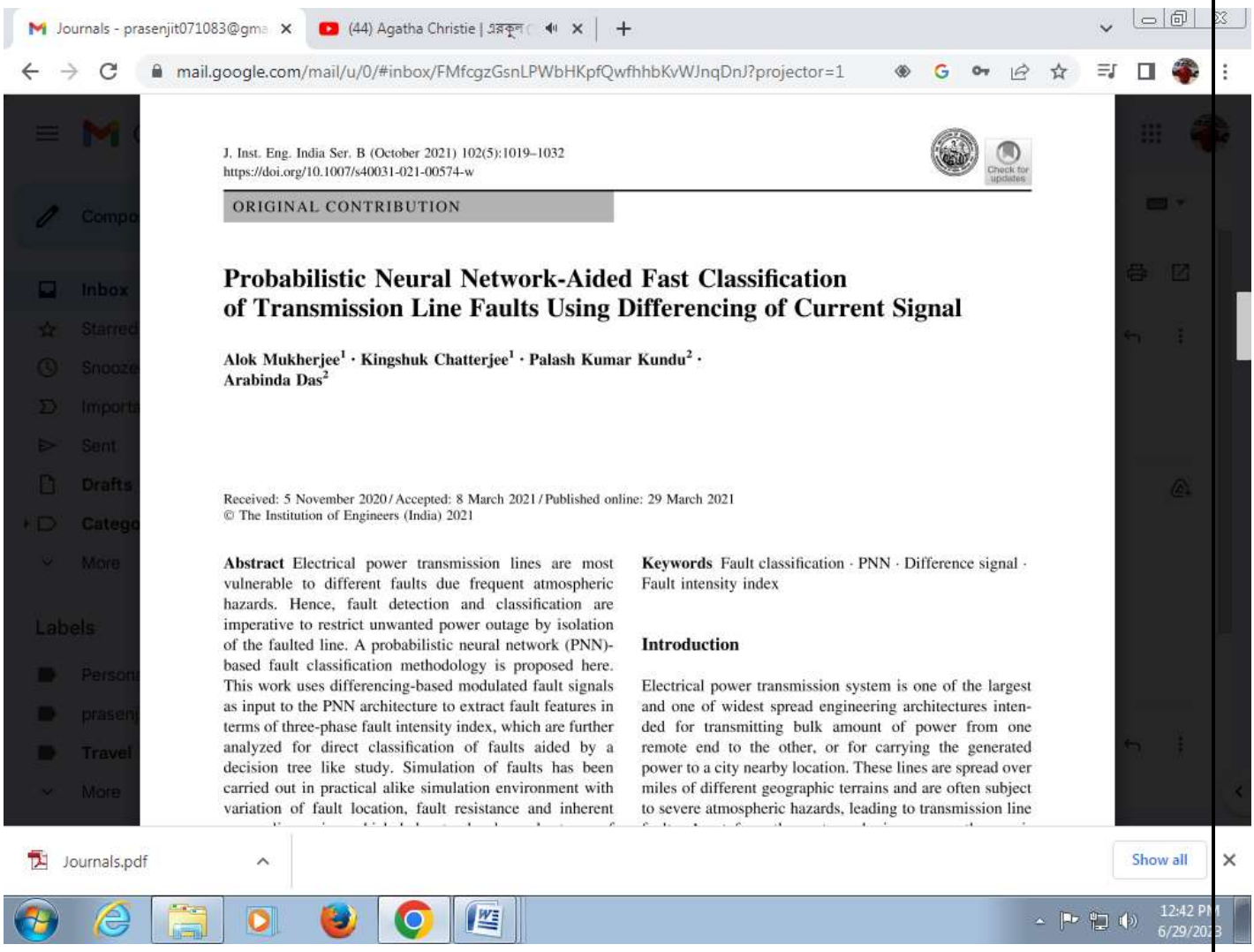
Received: 2 June 2020 / Accepted: 11 January 2021 / Published online: 3 February 2021

Abstract
Fault localization in power transmission line has been a key area of research, especially with the advent of modern soft computation-based digital relaying schemes. In this article, a principal component analysis (PCA)-based method of fault detection and localization in an overhead transmission line is proposed. The analysis is carried out for single line to ground faults only as these faults encompass about 70–90% among all the faults in transmission lines; although this generalized method could also be extended to cater other fault prototypes too. A fault in a line causes disturbances in the form of high-frequency transient oscillations which are developed immediately after the fault. The peaks and crests of these fault transients are investigated as key features from the receiving end three-phase voltage signals. These feature points are fed to a PCA-based fault localizer algorithm as supervised inputs. The proposed model is tested with a large set of fault signals, varying all the three major influencing parameters like fault locations, fault resistances as well as fault inception angle. Power system noise is also incorporated additionally in the fault signals order to incorporate more robustness to the localizer model. An average localization percentage error of 0.871% ranging from 0.011 to 2.413% is obtained from this work. The proposed work requires only a maximum of nearly 10.1% of post-cycle fault signal for analysis, which is remarkably less compared to several other schemes.

Keywords Peaks and crests · PCA · Fault localization · Fault transients · Feature points · Percentage error

1 Introduction

fault causing element, thus restoring normal power flow at



J. Inst. Eng. India Ser. B (October 2021) 102(5):1019–1032
https://doi.org/10.1007/s40031-021-00574-w

ORIGINAL CONTRIBUTION

Probabilistic Neural Network-Aided Fast Classification of Transmission Line Faults Using Differencing of Current Signal

Alok Mukherjee[1] · Kingshuk Chatterjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 5 November 2020 / Accepted: 8 March 2021 / Published online: 29 March 2021

Abstract Electrical power transmission lines are most vulnerable to different faults due frequent atmospheric hazards. Hence, fault detection and classification are imperative to restrict unwanted power outage by isolation of the faulted line. A probabilistic neural network (PNN)-based fault classification methodology is proposed here. This work uses differencing-based modulated fault signals as input to the PNN architecture to extract fault features in terms of three-phase fault intensity index, which are further analyzed for direct classification of faults aided by a decision tree like study. Simulation of faults has been carried out in practical alike simulation environment with variation of fault location, fault resistance and inherent

Keywords Fault classification · PNN · Difference signal · Fault intensity index

Introduction

Electrical power transmission system is one of the largest and one of widest spread engineering architectures intended for transmitting bulk amount of power from one remote end to the other, or for carrying the generated power to a city nearby location. These lines are spread over miles of different geographic terrains and are often subject to severe atmospheric hazards, leading to transmission line

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https://doi.org/10.1007/s00202-021-01285-7

ORIGINAL PAPER

Classification and localization of transmission line faults using curve fitting technique with Principal component analysis features

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

Received: 28 August 2020 / Accepted: 31 March 2021 / Published online: 13 April 2021

Abstract
This paper investigates the application of Principal Component Analysis (PCA) for the development of a simple method of classification and localization of power system faults for a 150 km long transmission line. The proposed work uses only a quarter cycle pre-fault and half cycle post-fault receiving end line current signals for fast identification and isolation of the faulty line. This work analyzes current data of ten different fault classes. The fault signals are recorded at fourteen intermediate geometric locations, out of which, three locations are used for developing the PCA-ratio based classifier and a total of six locations are used for developing the localizer model. PCA is applied here to develop PC score indices, based on which, fault signature curve is developed using best fit analogy. This curve works as the key signature of localizer for each class and phase. The work is made more practically suited by incorporating noise in the signals. Thus an effort has been made in the proposed work for developing a complete practical fault diagnosis algorithm with an aim to achieve high level of accuracy both to classify and localize fault. The proposed classifier is found to produces 100% accuracy, and the localizer is found to achieve an average localization error of only 0.1189% for 40 dB SNR and 0.3965% error at a further higher noise level of 25 dB SNR, with less than 4% of maximum error.

Keywords Principal component analysis (PCA) · Principal component indices (PCI) · Ratio indices (RI) · Best fit curve analysis · Percentage error

1 Introduction

the faulted line. This also helps in preventing damage to the equipments, and most importantly, preventing damage to the

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ORIGINAL CONTRIBUTION

Transmission Line Fault Classification under High Noise in Signal: A Direct PCA-Threshold-Based Approach

Alok Mukherjee[1] · Palash Kumar Kundu[2] · Arabinda Das[2]

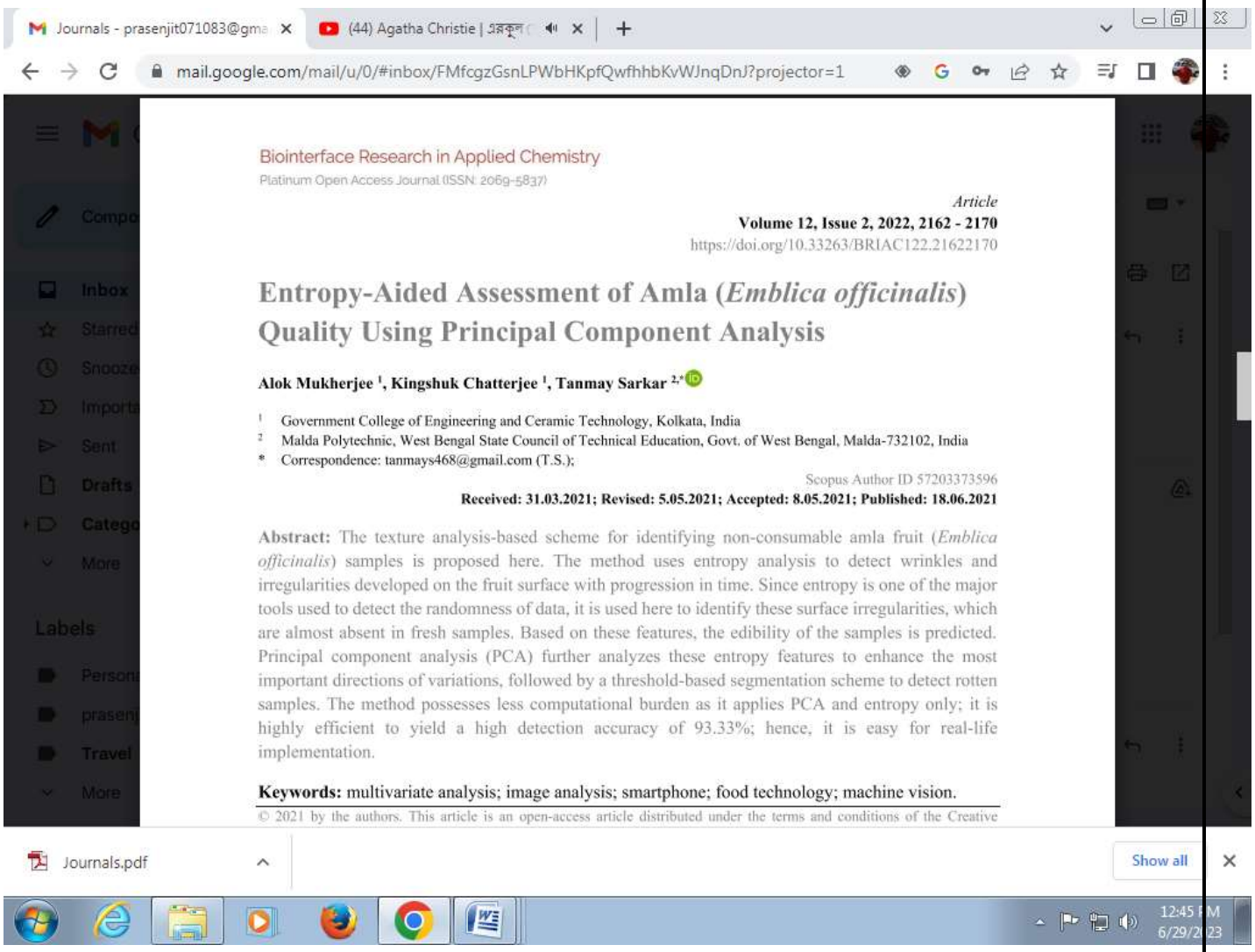
Received: 15 November 2020 / Accepted: 17 April 2021 / Published online: 15 June 2021

Abstract Transmission line faults are most common in long distance power transmission system. Classification of faults is crucial in removal of the faulted line from supply end in order to discontinue the unwanted flow of power through the fault point. The proposed work illustrates a simple method of classification of faults in transmission line using Principal Component Analysis- (PCA) based approach. The proposed method uses to extract fault features in terms of Principal Component Index (PCI), followed by a threshold-based analysis of the PCI values. Development of two threshold values helps in segregating the three different levels of fault disturbance in terms of the PCI values, thereby, developing fault signatures for classification. A 150 km transmission line has been modeled in EMTP for simulating the different fault prototypes, fol-

Keywords Principal Component Analysis (PCA) · Principal Component Index (PCI) · Fault classification · Signal to noise ratio (SNR) · Classifier accuracy

Introduction

Power transmission system is one among the most widespread networks. These transmission lines spread across long distances and go through different terrains. Hence, these are often subject to different faults. Different environmental constraints like storm, snow, ice, etc., often initiate faults in these lines. Several other factors like the presence of different animals, birds as and growing vegetation, weeds and other parts of the trees often cause short



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Article
Volume 12, Issue 2, 2022, 2162 - 2170
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Entropy-Aided Assessment of Amla (*Emblica officinalis*) Quality Using Principal Component Analysis

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2 Malda Polytechnic, West Bengal State Council of Technical Education, Govt. of West Bengal, Malda-732102, India
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Scopus Author ID 57203373596

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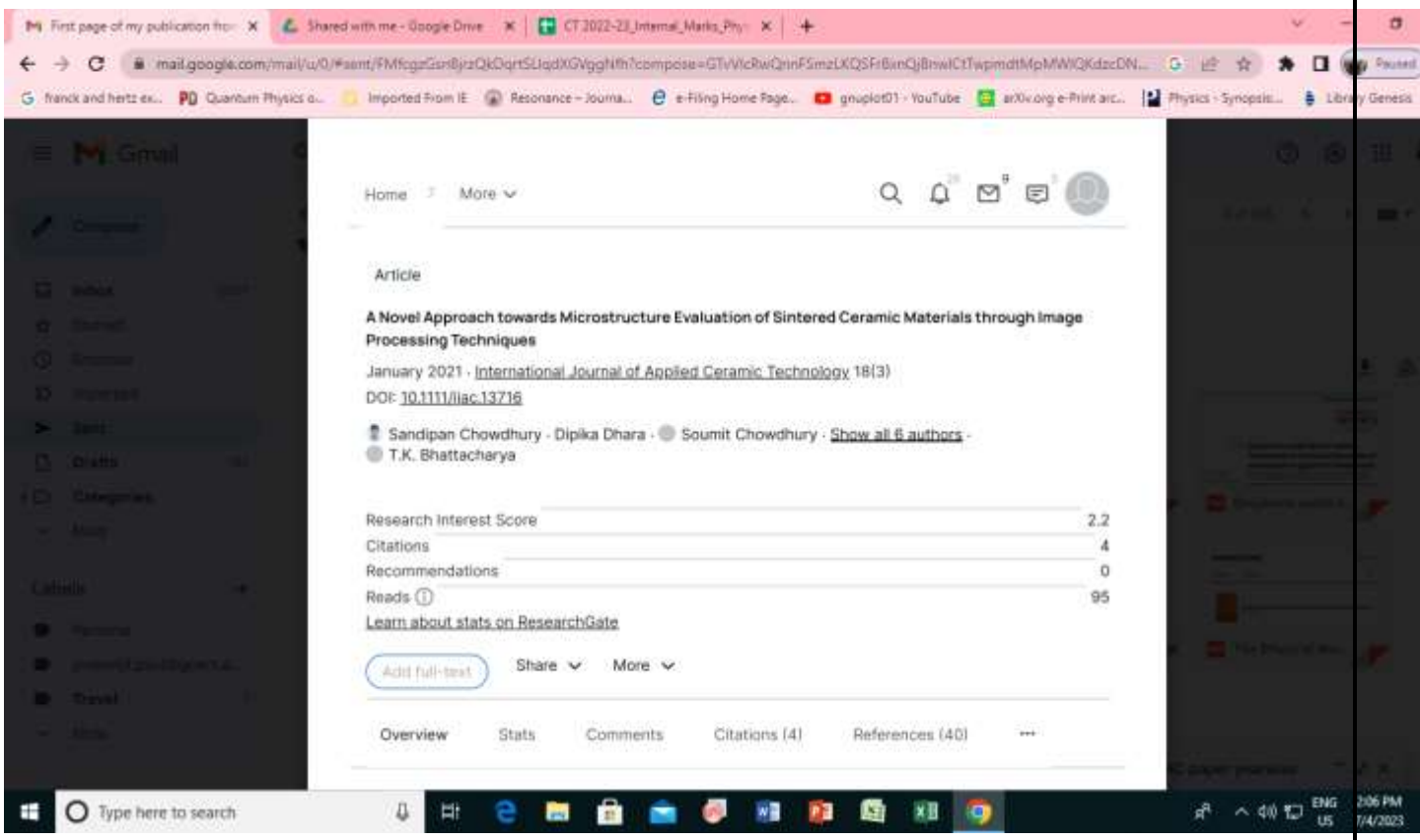
Abstract: The texture analysis-based scheme for identifying non-consumable amla fruit (*Emblica officinalis*) samples is proposed here. The method uses entropy analysis to detect wrinkles and irregularities developed on the fruit surface with progression in time. Since entropy is one of the major tools used to detect the randomness of data, it is used here to identify these surface irregularities, which are almost absent in fresh samples. Based on these features, the edibility of the samples is predicted. Principal component analysis (PCA) further analyzes these entropy features to enhance the most important directions of variations, followed by a threshold-based segmentation scheme to detect rotten samples. The method possesses less computational burden as it applies PCA and entropy only; it is highly efficient to yield a high detection accuracy of 93.33%; hence, it is easy for real-life implementation.

Keywords: multivariate analysis; image analysis; smartphone; food technology; machine vision.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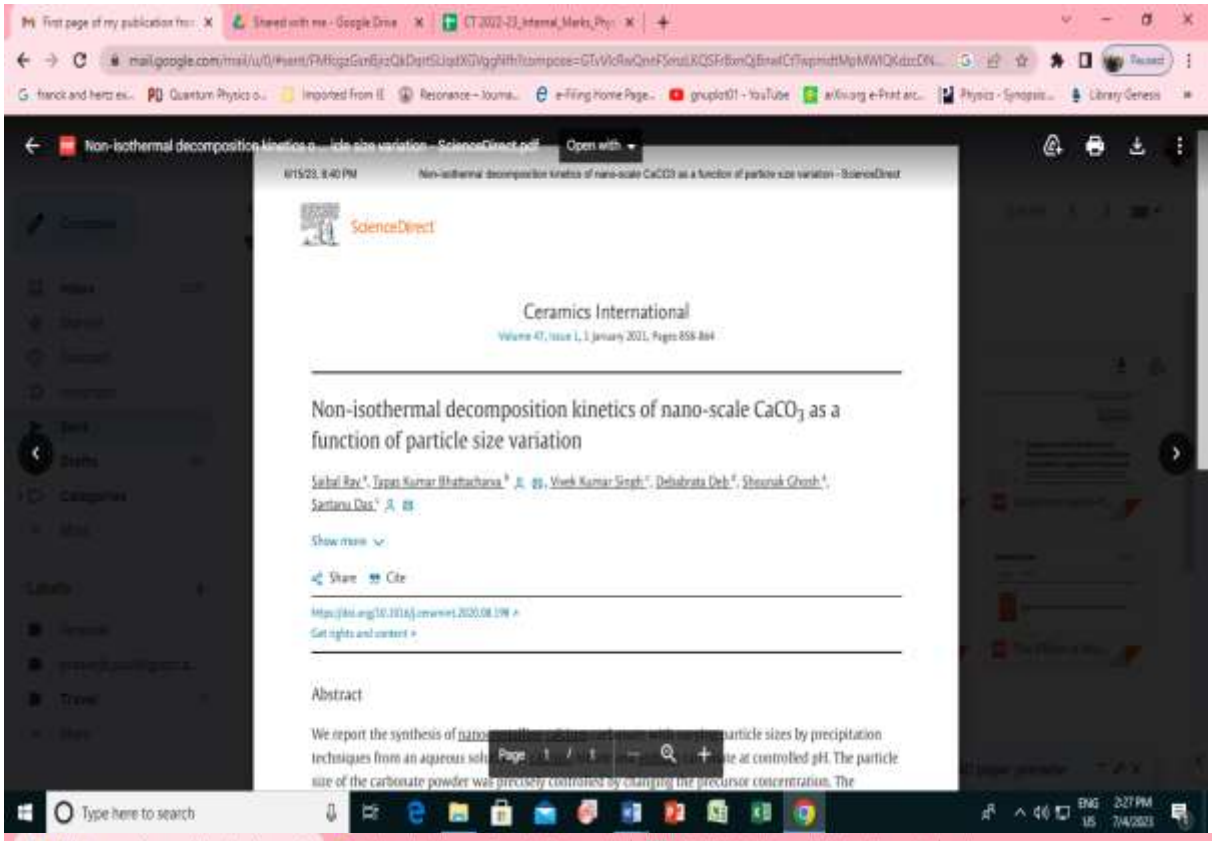
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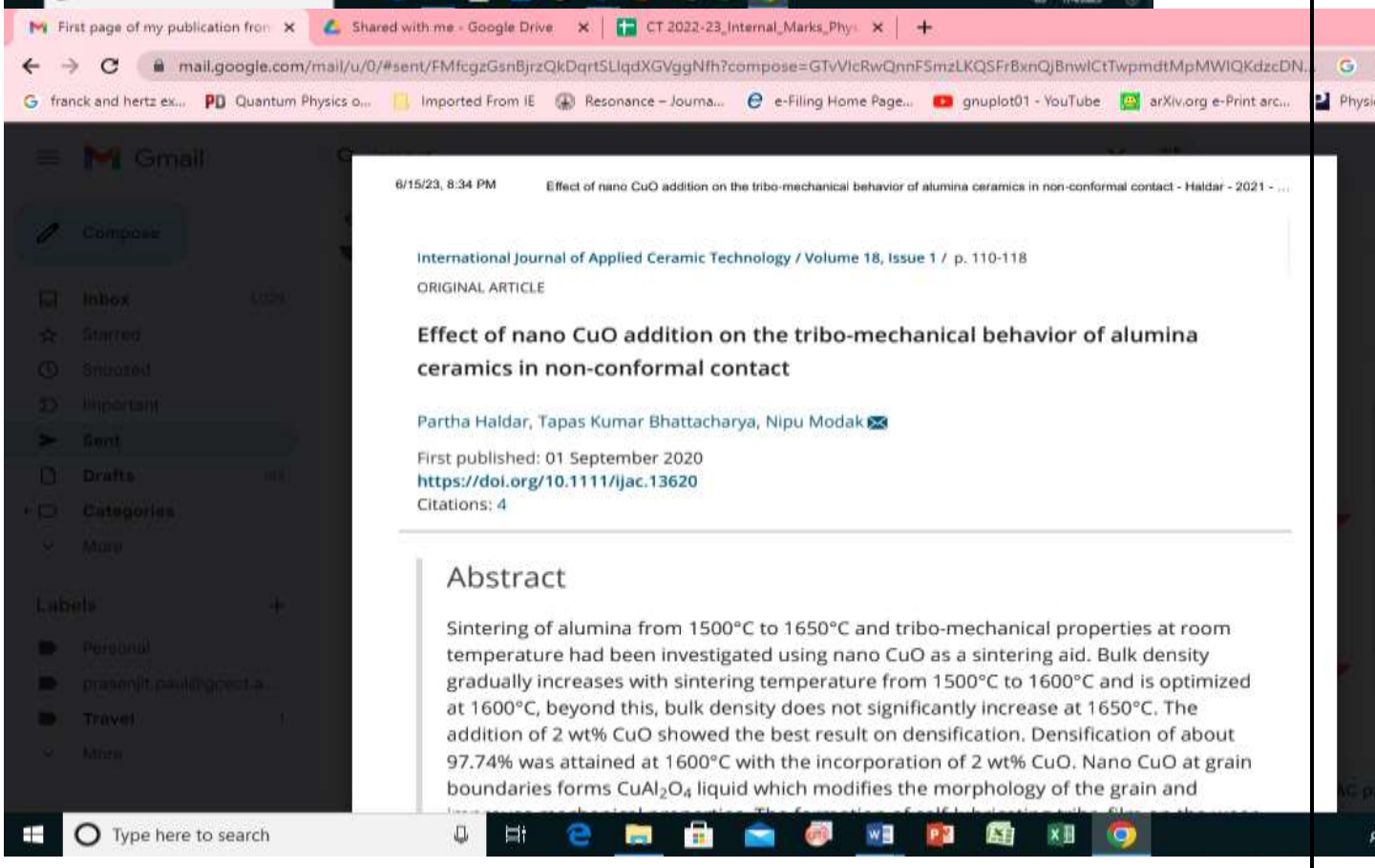
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Effect of nano CuO addition on the tribo-mechanical behavior of alumina ceramics in non-conformal contact - Haldar - 2021 - ...
International Journal of Applied Ceramic Technology / Volume 18, Issue 1 / p. 110-118
ORIGINAL ARTICLE
Effect of nano CuO addition on the tribo-mechanical behavior of alumina ceramics in non-conformal contact
Partha Haldar, Tapas Kumar Bhattacharya, Nipu Modak
First published: 01 September 2020
https://doi.org/10.1111/ijac.13620
Citations: 4
Abstract
Sintering of alumina from 1500°C to 1650°C and tribo-mechanical properties at room temperature had been investigated using nano CuO as a sintering aid. Bulk density gradually increases with sintering temperature from 1500°C to 1600°C and is optimized at 1600°C, beyond this, bulk density does not significantly increase at 1650°C. The addition of 2 wt% CuO showed the best result on densification. Densification of about 97.74% was attained at 1600°C with the incorporation of 2 wt% CuO. Nano CuO at grain boundaries forms $CuAl_2O_4$ liquid which modifies the morphology of the grain and
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Indian J Phys
https://doi.org/10.1007/s12648-020-01877-2

ORIGINAL PAPER

Cosmological models with variable anisotropic parameter in $f(R, T)$ gravity

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Abstract: In this article, we present and analyze cosmological models with an anisotropic variable parameter. We have set up the field equations with the space time in the form of Bianchi I metric with an $f(R, T)$ gravity. The functional form for the $f(R, T)$ gravity has been assumed to be $f(R, T) = R + 2f(T)$, where R and T are, respectively, the Ricci scalar and trace of the energy–momentum tensor. Two different models are constructed with respect to the scale factors, such as power law scale factor and hybrid scale factor. Moreover, the anisotropic parameter taken here in the form of hyperbolic function further gives clarity on the behavior of equation of state parameter. It is to note that when the values of the coefficient constant vanish, the model yields the isotropic universe. For both the cases, the deceleration parameter, state finder diagnostic pair and energy conditions have been obtained and analyzed which provide physical plausibility of the models.

Keywords: General relativity; Cosmology; Anisotropy; Equation of state; Deceleration parameter

1. Introduction

The Einstein field equations (EFE) signify the interplay between matter source and space–time geometry of the universe. Based on the EFE, i.e., $G_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \kappa T_{\mu\nu}$, the presence of energy–momentum distribution has given the clue that the "Space–time commands the matter on its movement and simultaneously matter commands space–time on its curving" [1].

However, besides the success of the theory of general relativity (GR) in several physical aspects, still some astrophysical as well as cosmological issues had not found an appropriate explanation from the GR theory. The observational evidence of late time cosmic acceleration is one of such hidden stories of cosmology among other indescribable phenomena by GR [2]. Modified gravity has been prominent among other alternatives to GR for answering the issue of late time cosmic acceleration. The recent pioneering cosmological observations, viz. Supernova Type Ia (SNIa) [3], Cosmic Microwave Background (CMB) [4], Baryon Acoustic Oscillation (BAO) [5], Wilkinson Microwave Anisotropy Probe (WMAP) [6] and the most recent Planck collaboration [7], confirm that our present universe not only expands but also goes through the accelerated expanding phase which immediately challenged regarding the viability of GR in the large cosmic scale.

As a result, in recent time plethora of modified theories on gravitation have been proposed. Among all these theories, $f(R)$ gravity [8–12], $f(G)$ gravity [13–15], $f(R, G)$ gravity [16, 17], $f(T)$ gravity [18–20] and $f(R, T)$ gravity [21] have received much attention. In these alternative gravity theories, the gravitational Lagrangian density of the Einstein–Hilbert action has been modified by considering generalized functional form of the argument. It is observed that the cosmological models based upon modified gravity theories can easily address to the galactic as well as extra-galactic cosmic dynamics and hence show excellent consistency between the observational dynamics [22–25] and proposed theoretical predictions.

Recently, Harko and collaborators [21] have introduced a new kind of modified theory of gravity under the name $f(R, T)$ gravity. In various contexts of astrophysics and cosmology, such as thermodynamics [26, 27], energy

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ORIGINAL PAPER

Analytic radiation model for perfect fluid under homotopy perturbation method

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Received: 24 January 2019 / Accepted: 11 February 2020

Abstract: An expression for mass of a spherically symmetric system is obtained by solving the Tolman–Oppenheimer–Volkoff equation, employing the homotopy perturbation method. With the help of this expression and the Einstein field equations, a set of interior solutions is arrived at. Thereafter, different aspects of the solution are explained as regards mass, density, pressure, energy, stability, mass–radius ratio, compactness factor and surface redshift. This analysis shows that all the physical properties, in connection to brown dwarf stars, are valid with the observed features.

Keywords: General relativity; Homotopy perturbation method; Compact stars

1. Introduction

There has always been a search for the interior solution of the spherically symmetric system. More than several hundreds of different types of interior solutions have been suggested but so far, very few solutions have made its physical acceptance in all aspects describing the system.

However, in the present paper we have studied a spherically symmetric stellar system under the homotopy perturbation method (HPM) which was introduced and developed by He [1–7] and others [8–12]. This is a series expansion method used in the solution of nonlinear partial differential equations, in the present case the Einstein field equations of general relativity. The method in principle employs a homotopy transform to generate a convergent series solution of differential equations. He [3] advocated in favour of homotopy as well as perturbation technique to solve nonlinear problems. Subsequently, other workers also applied the HPM in various fields of pure and applied mathematics including physics and astrophysics as a new field of application. This has made it possible to solve the related nonlinear differential equations in an extraordinarily simplified way [13–16].

Rahaman et al. [17] proposed and analysed a model for the existence of strange stars. They predicted a mass function for the ultra dense strange stars. The interpolation technique has been used to estimate the cubic polynomial that yields the following expression for the mass as a function of the radial coordinate $m(r) = ar^3 - br^2 + cr - d$ with a, b, c and d all being numerical constants. Their analysis is based on the MIT bag model and yields physically valid energy density, radial and transverse pressures.

However, in the above mentioned work of Rahaman et al. [17] the target object was a strange star. In our present investigation, we start with the intention to develop a basic interior solution of the Einstein equations valid for any radiating model under a similar expression for the mass as a function of the radial coordinate, i.e., $m(r)$. Then we match our theoretically obtained solution set with the observational results for practical validity of the model and find that our model is the best fit for the brown dwarf star of $E0$ type. Brown dwarfs [18] are considered as very faint, small in size and low mass ($M \leq 0.08 M_{\odot}$) sub-stellar objects mainly composed of hydrogen and helium. It is the mass of a star which helps to maintain hydrostatic equilibrium. A minimum mass ($\approx 0.08 M_{\odot}$) is required for stable burning of hydrogen fuel in the core of the star.

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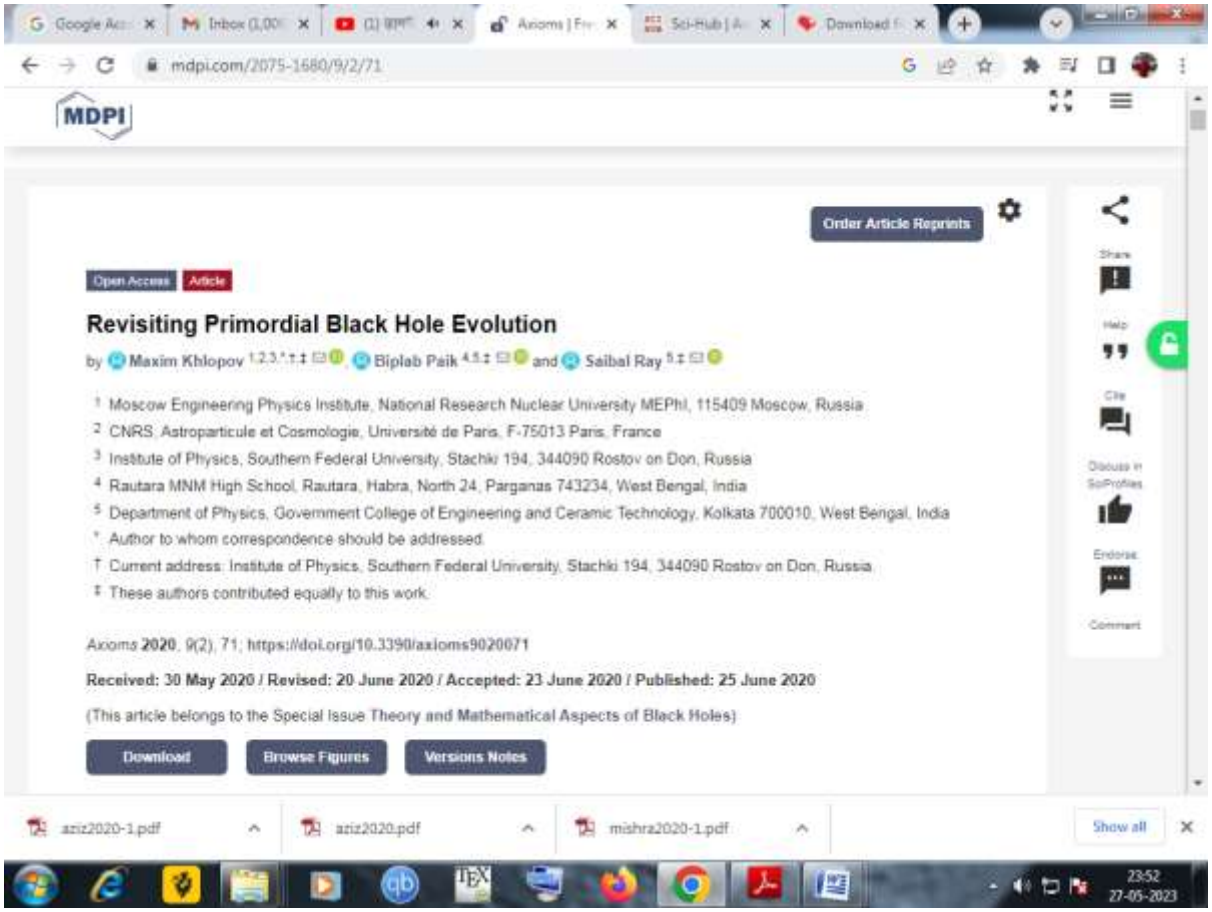
Published online: 25 July 2020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Revisiting Primordial Black Hole Evolution
by Maxim Khlopov [1,2,3,*,†,‡] Biplab Paik [4,5,‡] and Saibal Ray [5,‡]
[1] Moscow Engineering Physics Institute, National Research Nuclear University MEPhI, 115409 Moscow, Russia
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[3] Institute of Physics, Southern Federal University, Stachki 194, 344090 Rostov on Don, Russia
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† Current address: Institute of Physics, Southern Federal University, Stachki 194, 344090 Rostov on Don, Russia.
‡ These authors contributed equally to this work.
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(This article belongs to the Special Issue Theory and Mathematical Aspects of Black Holes)
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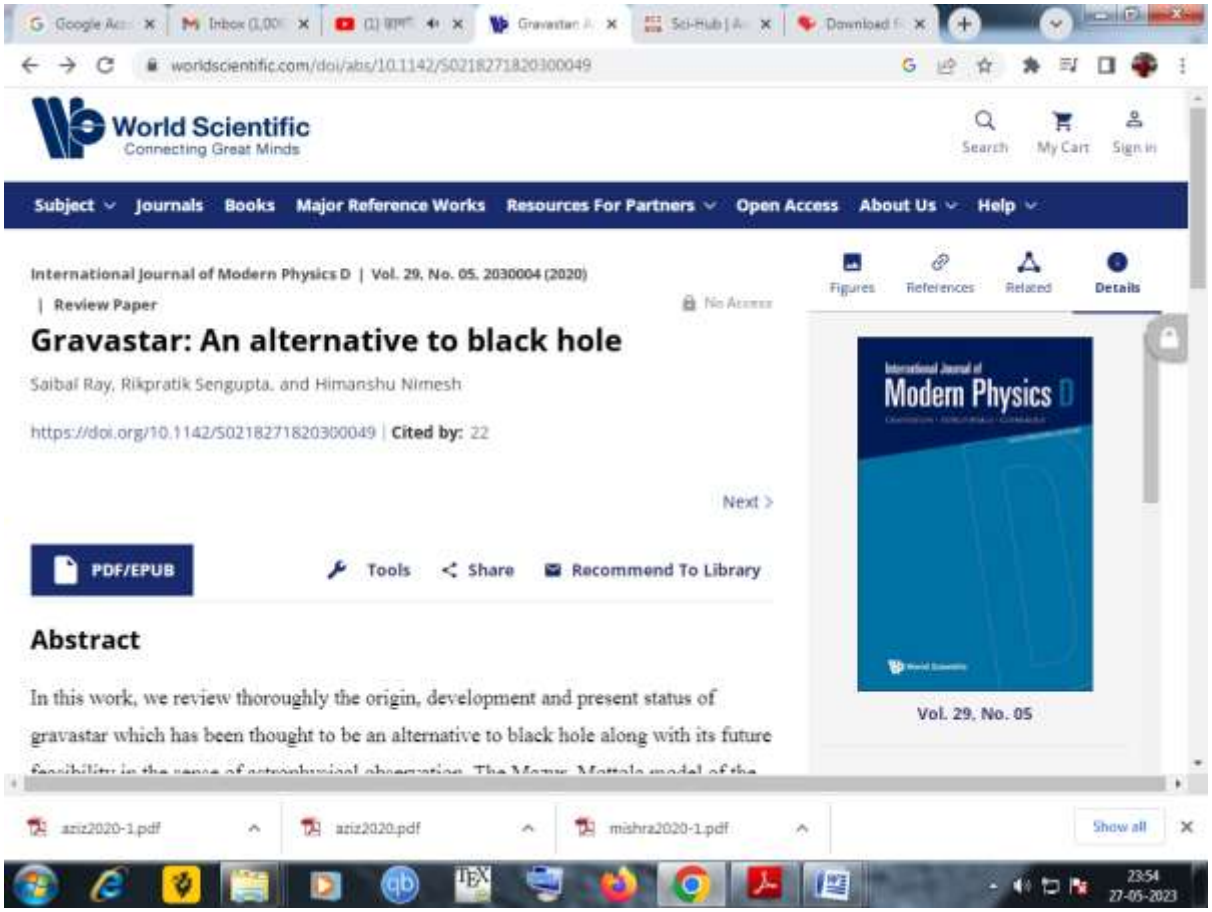
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Saibal Ray, Rikpratik Sengupta, and Himanshu Nimesh
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Abstract
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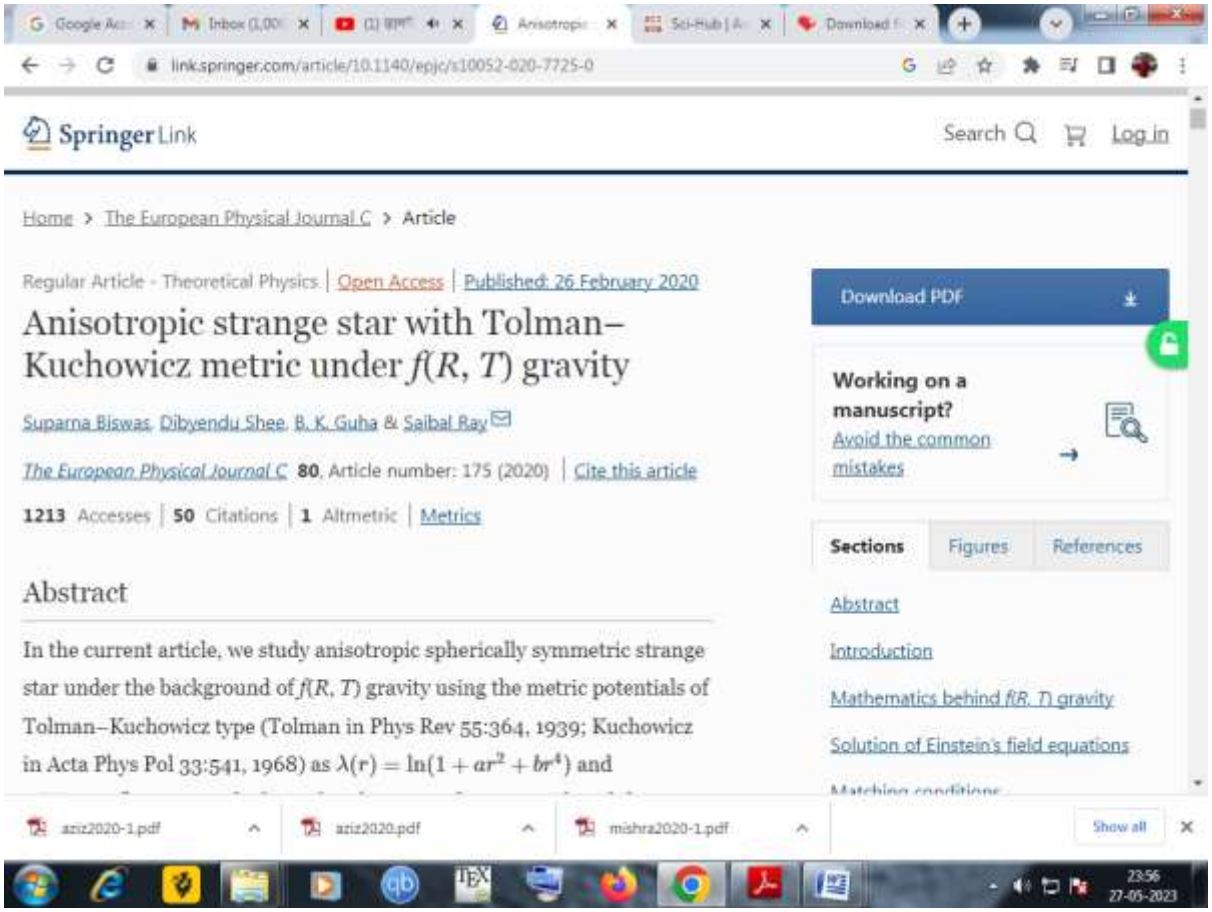
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Anisotropic strange star with Tolman–Kuchowicz metric under $f(R, T)$ gravity
Suparna Biswas, Dibyendu Shee, B. K. Guha & Saibal Ray
The European Physical Journal C 80, Article number: 175 (2020) | Cite this article
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Abstract
In the current article, we study anisotropic spherically symmetric strange star under the background of $f(R, T)$ gravity using the metric potentials of Tolman–Kuchowicz type (Tolman in Phys Rev 55:364, 1939; Kuchowicz in Acta Phys Pol 33:541, 1968) as $\lambda(r) = \ln(1 + ar^2 + br^4)$ and
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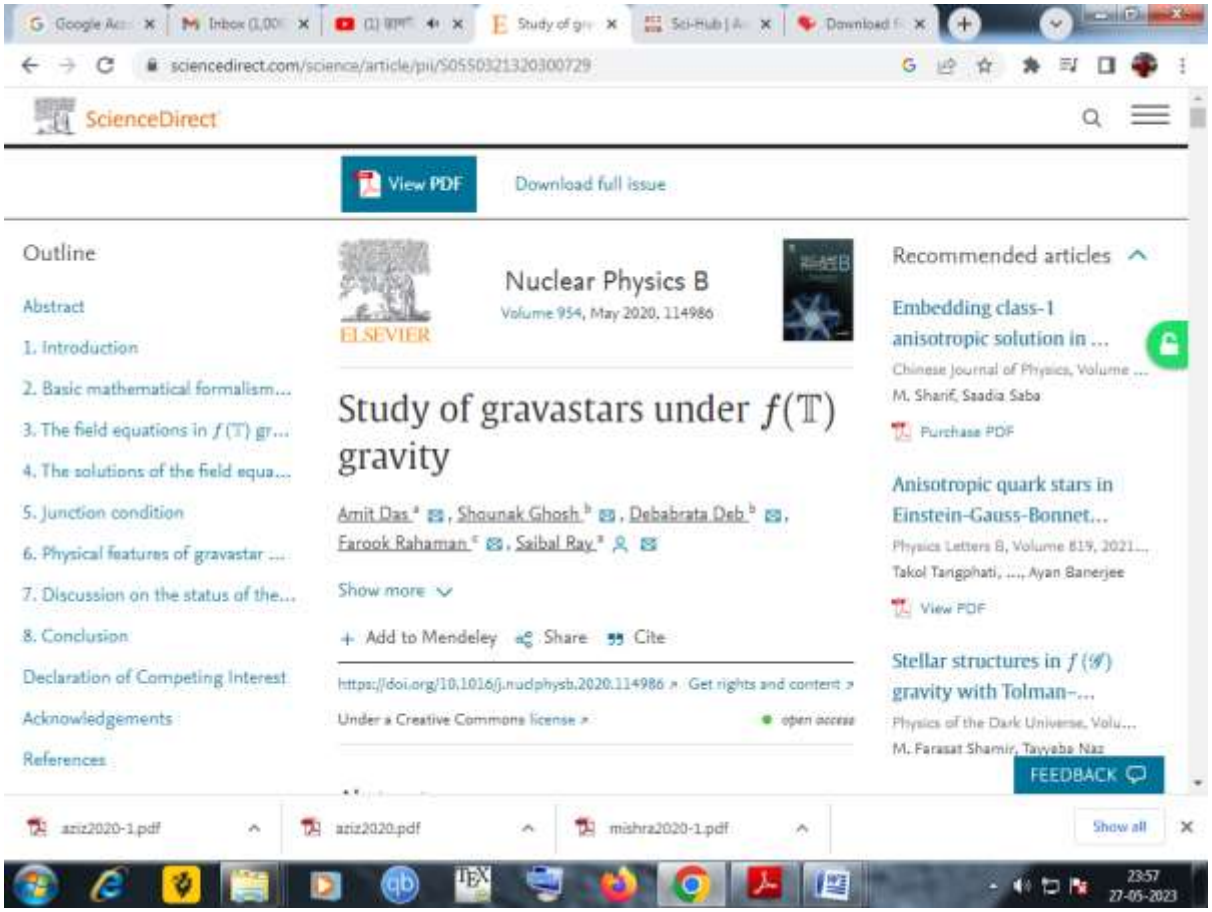
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Outline
Abstract
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3. The field equations in f (T) gr...
4. The solutions of the field equa...
5. Junction condition
6. Physical features of gravastar ...
7. Discussion on the status of the...
8. Conclusion
Declaration of Competing Interest
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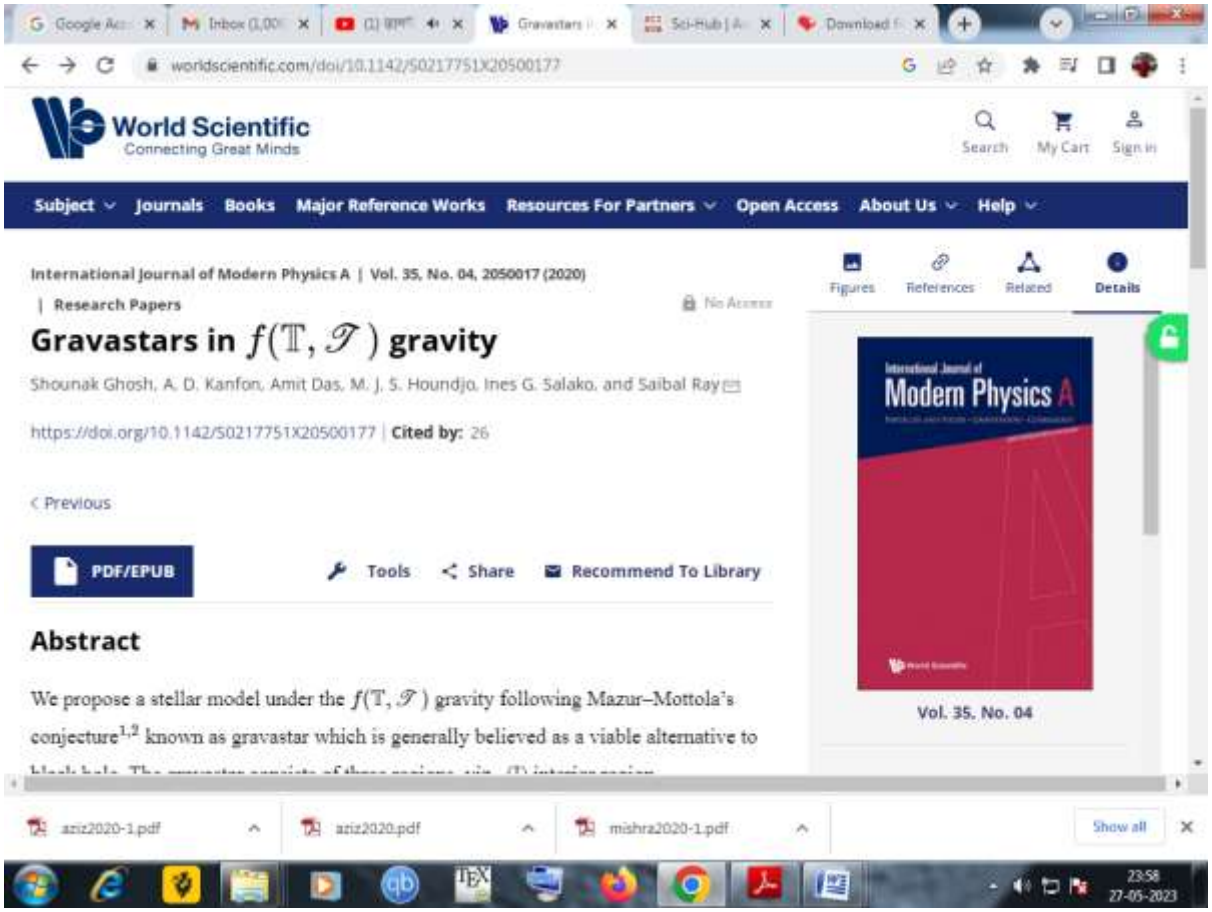
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Shounak Ghosh, A. D. Kanfon, Amit Das, M. J. S. Houndjo, Ines G. Salako, and Saibal Ray
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Abstract
We propose a stellar model under the $f(\mathbb{T}, \mathscr{T})$ gravity following Mazur–Mottola's conjecture[1,2] known as gravastar which is generally believed as a viable alternative to
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ORIGINAL PAPER

Charged perfect fluid sphere in higher-dimensional spacetime

P Bhar[1,2], T Manna[1,2], F Rahaman[2,3], S Ray[2,4,5]* and G S Khadekar[2,6]

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Received: 17 January 2019 / Accepted: 23 July 2019

Abstract: In the present paper, a new model for perfect fluid sphere filled with charge, in higher-dimensional spacetime, admitting conformal symmetry has been investigated. We have considered a linear equation of state, with coefficients fixed by the matching conditions, at the boundary of the source corresponding to the exterior Reissner–Nordström higher-dimensional spacetime. Several physical features for different dimensions, starting from four up to eleven, have been briefly discussed. It has been shown that all the features as obtained from the present model are physically desirable.

Keywords: General relativity; Equation of state; Higher dimension; Compact star

PACS Nos.: 04.40.Nr; 04.20.Cv; 04.20.Jb

1. Introduction

With the recent advancement in superstring theory, in which the spacetime is considered to be of dimensions higher than four, studies in higher-dimensional spacetime have attained tremendous importance. The higher-dimensional models provide a stand to realize the nature of the early universe. In the early stages, the universe was dense and hot. This scenario is better explained in higher dimensions. It is believed that during the expansion the extra dimensions have compactified to yield the current four-dimensional universe. Throughout the last decade, a number of articles have been published in this subject in both localized and cosmological domains. It is a common trend to believe that the four-dimensional present spacetime structure is the self-compactified form of manifold with multi-dimensions. Therefore, it is argued that theories of unification tend to require extra spatial dimensions to be consistent with the physically acceptable models [1–6]. It has been shown that some features of higher-dimensional black holes differ significantly from four-dimensional black holes as higher dimensions allow for a much richer landscape of black hole solutions that do not have four-dimensional counterparts [7]. Some recent higher-dimensional works admitting one parameter group of conformal motion can be seen in the following Refs. [8, 9].

Recently, the models for charged fluids that describe the ultra compact astrophysical objects have been studied extensively. These solutions describe charged compact objects that are well-matched with known stars. As a result, it is argued that the Einstein–Maxwell field equations have many applications in modeling the stars. It is observed that a fluid sphere of uniform density with a net surface charge becomes more stable than without charge [10]. According to Krasinski [11] in the presence of charge, the gravitational collapse of a spherically symmetric distribution of matter to a point singularity may be avoided. Sharma et al. [12] argued that in this situation the repulsive Coulombian force counterbalances the gravitational attraction in addition to the pressure gradient. Charged perfect fluid sphere satisfying a

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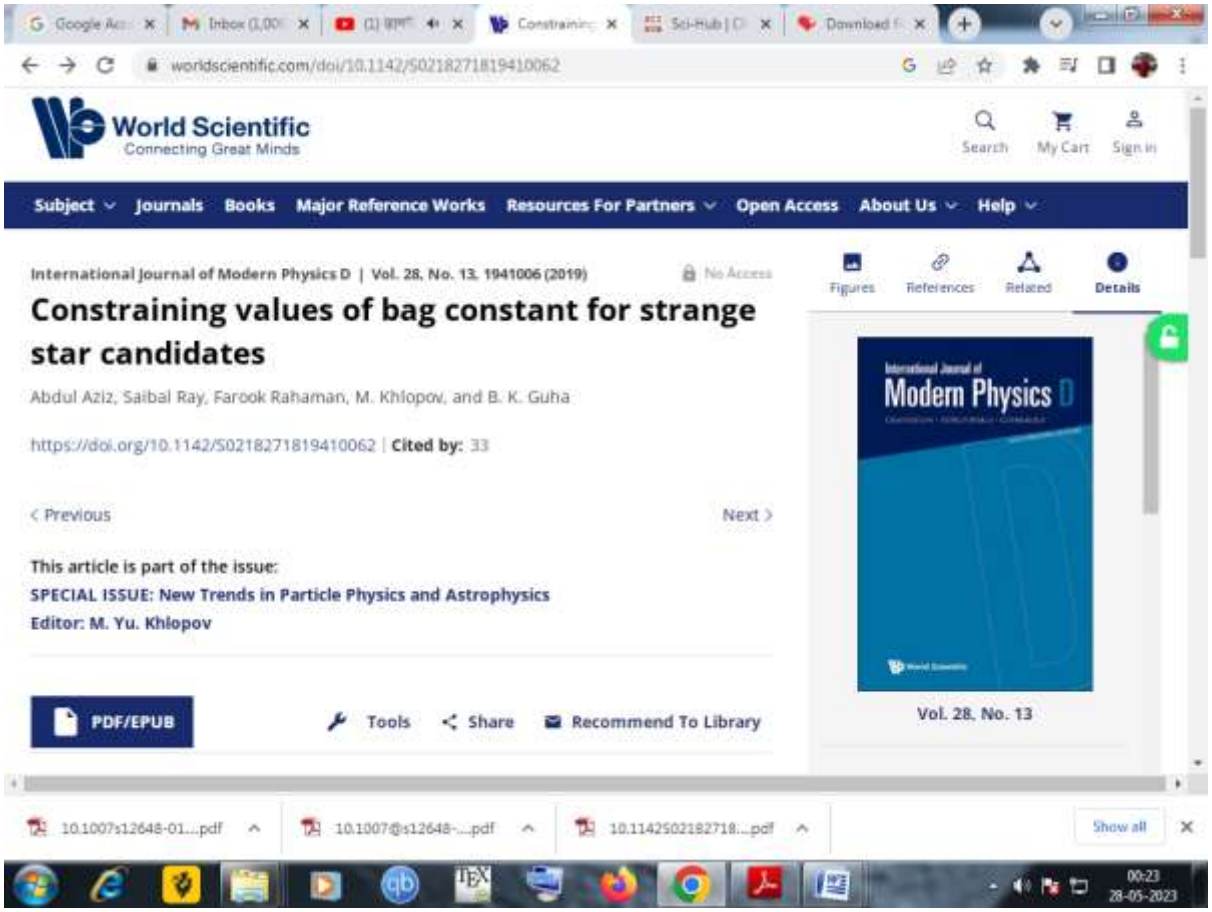
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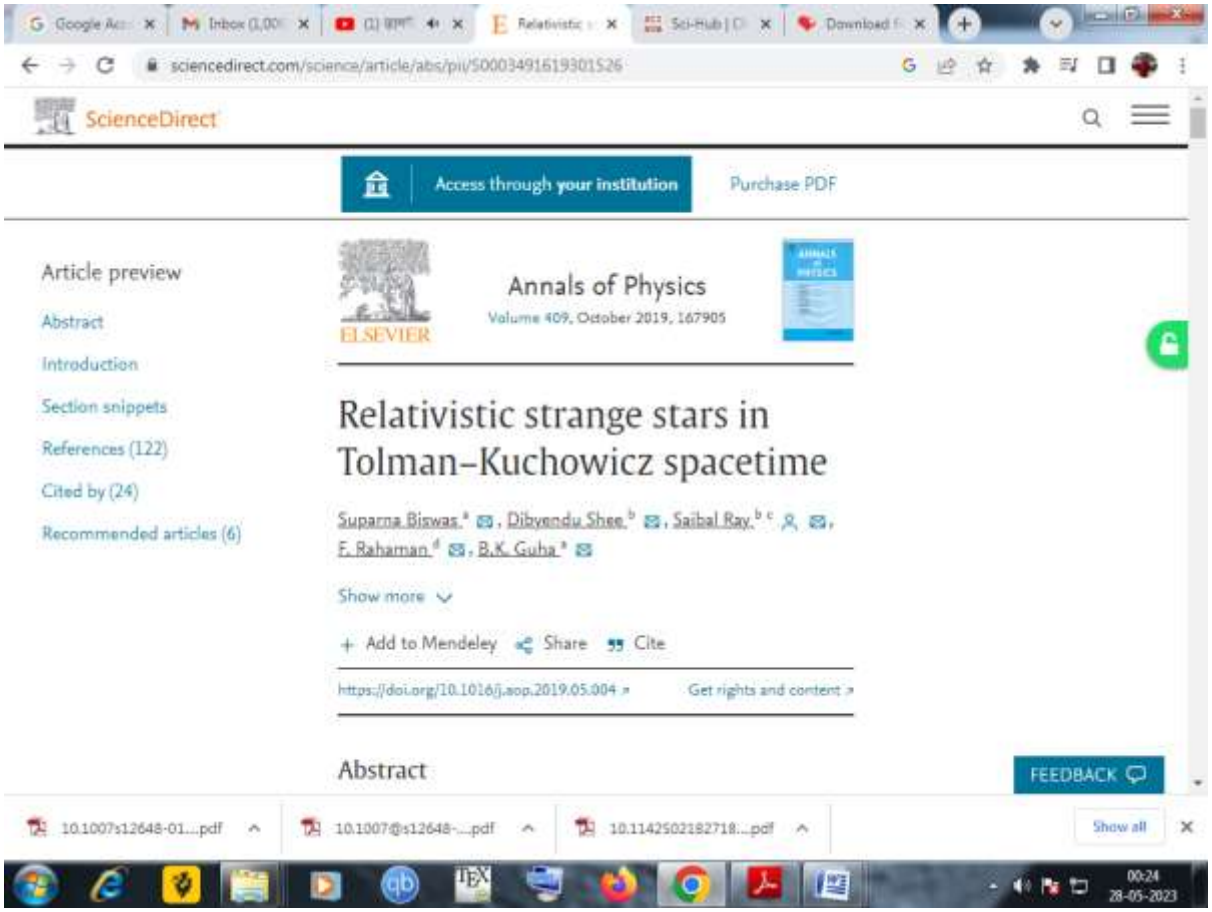
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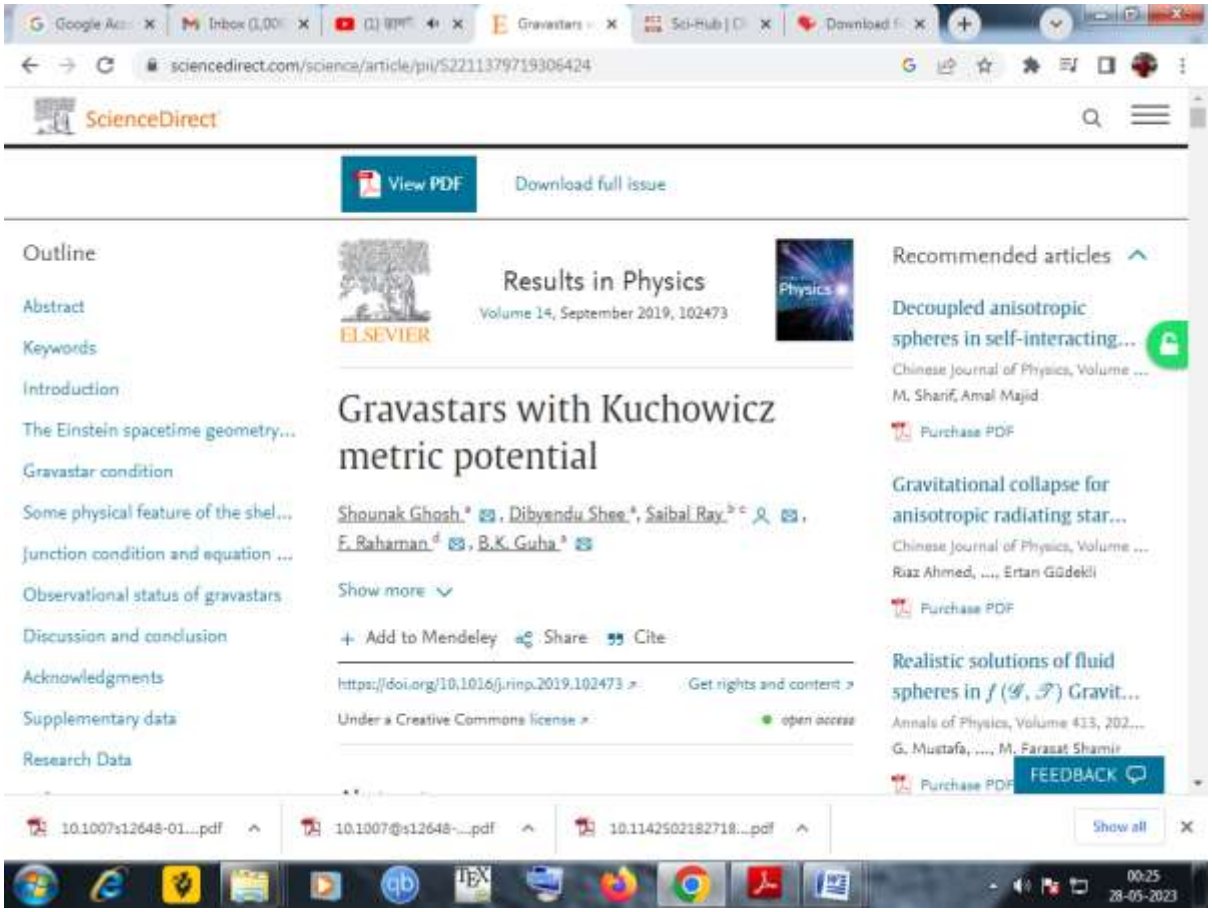
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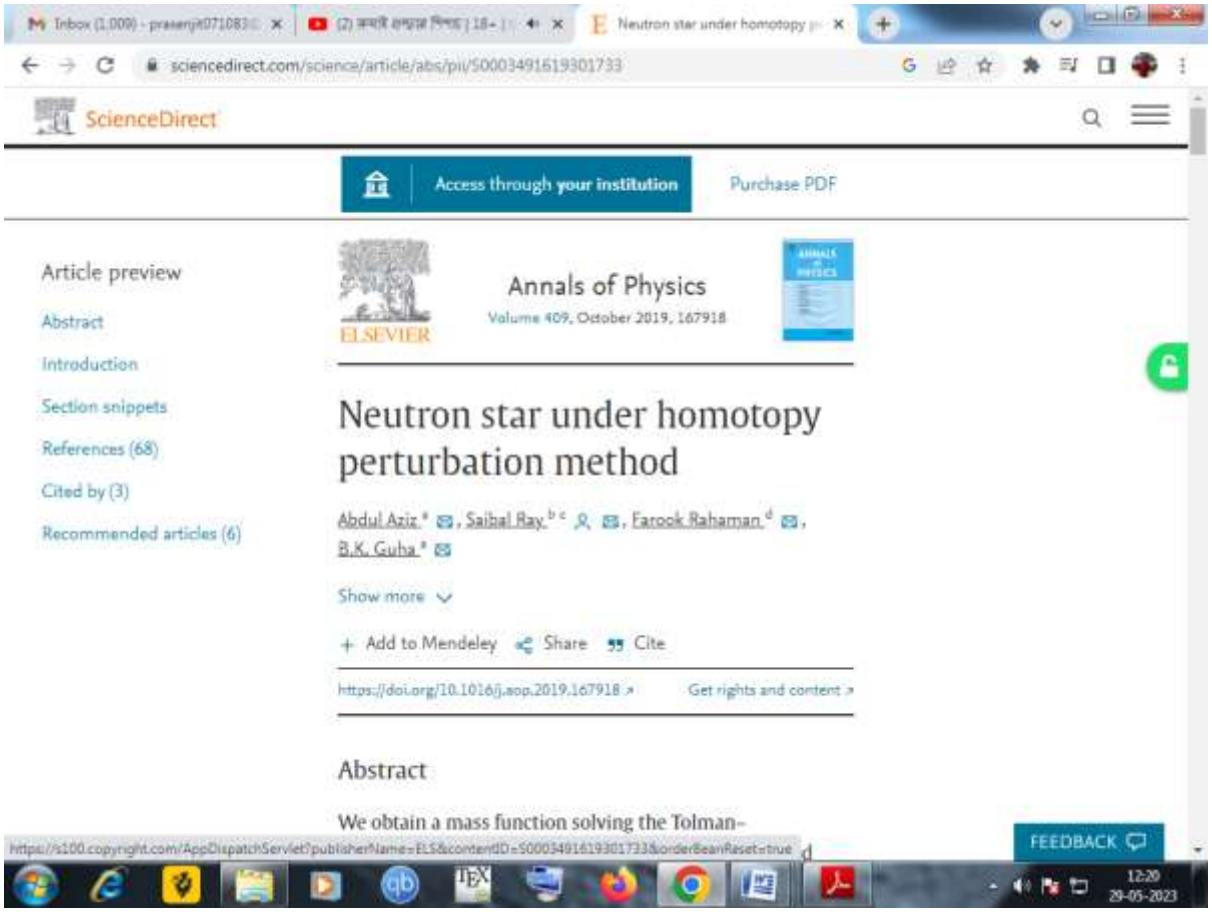
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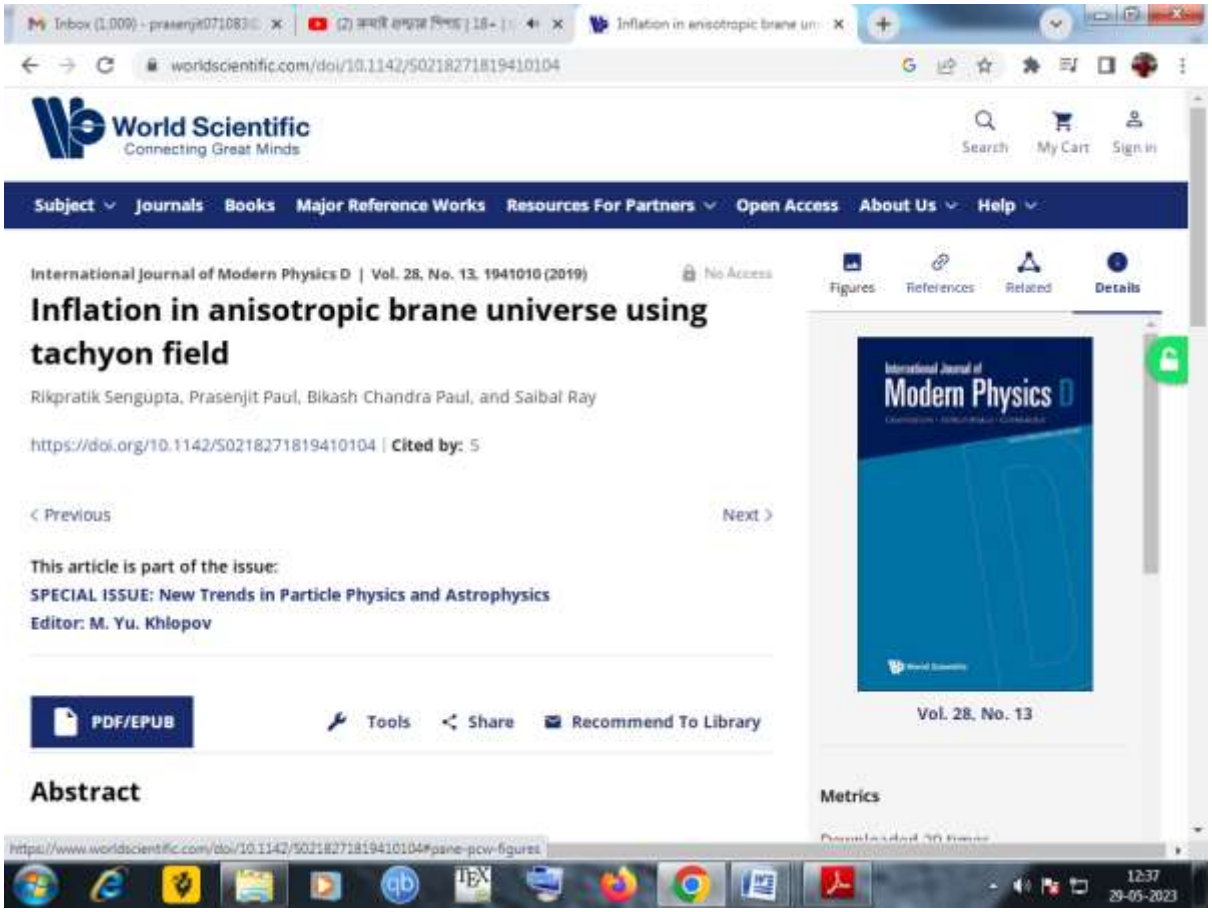
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Study on charged strange stars in $f(R,T)$ gravity

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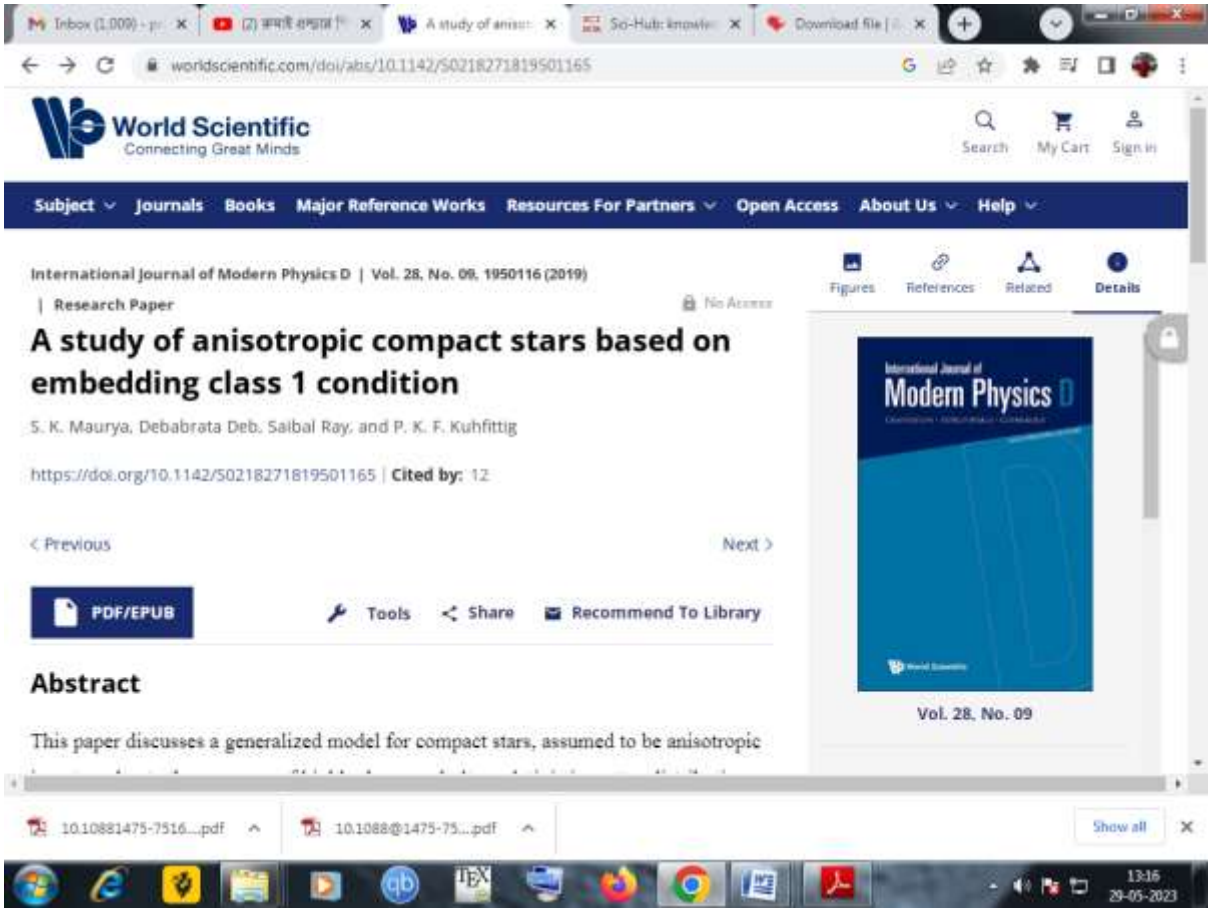
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International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075, Volume-8 Issue-10, August 2019

Multi-Phase Digital Authentication of e-Certificate with Secure Concealment of Multiple Secret Copyright Signatures

Soumit Chowdhury, Sontu Mistry, Nabin Ghoshal

Abstract: The work suggests a unique data security protocol for trusted online validation of e-documents like university certificates to confirm its credibility on different aspects. The idea reliably validates such e-documents from both the issuing authority and incumbent perspectives by strongly complying the security challenges like authentication, confidentiality, integrity and non-repudiations. At the very beginning, the parent institute physically issues the client copyright signature to the incumbent and stores this signature and biometric fingerprint of the incumbent on the server database. Additionally, the server secretly fabricates ownership signatures of parent institute and concern officer both within the e-document and this certified e-document is kept on the server database. Importantly, these signature fabrications are governed by self-defined hash computations on incumbent registration and certificate number respectively. Next, the server transmits this signed e-document to the client after a successful login by the client. Now client conceals shared copyright signature and taken thumb impression of the incumbent separately within this received e-document. Critically, these client-side signature castings are employed through self-defined hash computations on the incumbent name and obtained marks respectively. Finally, this authenticated e-document is validated at the server end by sensing all authentic signatures from it through those same identical hash operations. For stronger authenticity each signature is concealed by tracing its valid or authentic circular orientation of fragment sequences and embedding locations both derived from respective hash operations. Also, each signature is dispersed in non-overlapping manners on each separate region of the e-document promoting better signature recovery. Additional robustness is further injected with variable encoding of signature bits on different transformed pixel byte components of the e-Certificate image. Overall, the scheme confirms significant performance enhancements over existing approaches with exhaustive simulation results on image data hiding aspects and their standardized comparisons

Index Terms: e-Certificate Authentication, Hash-Based Validation, Multi-Signature Fabrication, Variable Encoding

Revised Manuscript Received on August 05, 2019

Soumit Chowdhury, Department of Computer Science and Engineering, Government College of Engineering & Ceramic Technology, Kolkata, India. (*Corresponding Author)

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I. INTRODUCTION

Rapid growth of digital data communication in recent time has urged the need for validation cum authentication of such digital documents in order to ensure trusted data transmission. In this aspect secret fabrication of some copyright signature on the concern e-document is the traditional practice to achieve ownership claims. This idea is mainly implemented through digital watermarking concepts where presence of such secretly fabricated signatures will remain unknown to the unauthorized recipients. Further, all these secretly embedded signatures also required to be protected from different external image processing attacks. Hence these approaches are quite useful for authenticating vital digital documents existing in the form of images such as e-certificates. Importantly this practice will be quite useful for online validation of such e-documents which are needed for the purpose of third-party verification. So, to emphasis this issue the proposed work designs a unique data security protocol for validation cum authentication of such e-documents and the main objective of this scheme are-

1. Achieving ownership claims for such e-documents from both the issuing authority and the candidate perspectives.
2. Data validations for the e-certificate using hash value-based signature fabrication concept which is performed on all the critical e-certificate data.
3. Complying critical data security issues like authentication, confidentiality, integrity, Non-repudiations.
4. Incorporation of secure data hiding techniques for signature fabrications using variable encoding of secret signature bits.

The vital issue here is that most of the existing works have actually focused such e-document authentications only by utilizing the idea of ownership claims. However, a digital document validation is a bigger issue where the authenticity of the whole document is important and, in this aspect, the existing works in this domain are highlighted further.

To depict the utility of these proposed concepts the paper is organized as follows- next sec. II discusses the existing works, followed by enhancements in sec. III.

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Zener-like electrical transport in polyaniline–graphene oxide nanocomposites

Animesh Kr. Dey,[a] Gaurav Kumar,[b] Pradip K. Maji,[b] A. K. Chakrabarty[c] and U. N. Nandi[a]*

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Accepted 20th December 2019

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The present study includes the fabrication and characterization and an investigation of the electrical transport properties of nanocomposites of n-PANI and graphene oxide (GO). The samples were prepared by loading different weight percentages D of GO during the chemical oxidative in situ polymerization of aniline monomers. Structural characterization by XRD, FTIR, FESEM, etc. confirmed that the nanocomposites exhibited superior morphology and thermal stability. The transport properties were studied by measuring the variation of conductivity with temperature T, V–I characteristics and the fundamental response V_1 at different temperatures T. The dc conductance S showed a transition from insulator type behavior to weakly temperature dependent behavior at temperature T_{ci}, which decreased with increasing D. The V–I characteristics were generally nonlinear and the nonlinearity increased with decreasing temperature. Moreover, at temperatures $T \gg T_{ci}$, the characteristics showed saturation of voltage for higher values of current, similar to Zener diodes. At lower temperatures ($T \approx T_{ci}$), a voltage maximum occurred, similar to thyristors. This behavior leads to the possibility of fabricating devices containing these nanocomposites. We have tried to analyze these results using the framework of scaling theory and the concept of inter-chain hopping conduction and tunneling between conducting grains separated by insulating regimes in the nanocomposite.

Introduction

Polyaniline (PANI) is one of the most studied organic polymers in materials science.[1,2] PANI exhibits exceptional physicochemical properties such as flexibility, solution processibility and tunable conductivity on undergoing reversible doping processes. Greater chemical and environmental stability, ease of synthesis and the large-scale availability of low cost monomers[3] make this polymer a good candidate for the development of functional carbon based polymer composites and the fabrication of numerous technological devices such as supercapacitors,[4–6] sensors,[7,8] electronic devices,[9] batteries[10,11] and light emitting diodes.[12] This polymer is available in three distinct oxidation states:[13] the fully reduced leucoemeraldine base (LB) $\{-(C_{24}H_{20}N_4)_n-\}$, the half-oxidized emeraldine base (EB) $\{-(C_{32}H_{24}N_4)_n-\}$ and the fully oxidized pernigraniline base (PNB) $\{-(C_{24}H_{16}N_4)_n-\}$. Both LB and EB are insulators with a large extrinsic gap $E_g \sim 3.6$ eV whereas PNB possesses an energy gap $E_g \sim 1.4$ eV and shows conducting properties due to electron–phonon interactions.[14] The conducting emeraldine salt (ES) form of the polymer is achieved upon protonation of EB by exposure to protic acids or upon oxidative doping of LB. This ES state is composed of two benzoid units and one quinoid unit that alternate and is regarded as the most useful form of polyaniline with semiconducting properties. This intrinsically conducting property[2] of the ES state of the polymer attracts researchers to explore its outstanding electrical, magnetic, electro-chemical, thermo-electrical, and optical properties.

In order to achieve superior electrical, thermal and mechanical properties to the corresponding component materials, various nanofillers such as camphor sulfonic acid,[15] graphene,[16–18] carbon nanotubes,[19,20] graphene oxide,[21–28] and reduced graphene oxide[29,30] have been added to PANI to fabricate innovative polyaniline nanocomposites of significant technological and scientific importance. Out of these carbon based materials, graphene oxide (GO) is extensively used as a filler in PANI because of its higher chemical stability, the easy availability of a low cost precursor (natural graphite), and the greater feasibility of large-scale production. Further, GO has structural advantages in which the edges are decorated with tunable polar oxygen-containing hydrophilic functional groups such as hydroxyl groups, carboxyl groups and epoxides.[31] These functional groups exhibit strong interfacial interactions with polar molecules and polymers resulting in intercalated or exfoliated GO-based polymer nanocomposites.[32–35] Moreover, the thermal stability of these nanocomposites is enhanced to a greater extent due to

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Nonlinearity exponent: A phase sensitive parameter in disordered systems

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ARTICLE INFO

Keywords:
Disordered systems
Onset frequency
Onset exponent
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ABSTRACT

The real part of alternating current conductance $\Sigma(T, f)$ of disordered systems shows nonOhmic behavior characterized by the existence of an onset frequency $f_c(T)$ below which $\Sigma(T, f)$ retains its Ohmic value Σ_0 but increases monotonically with frequency above $f_c(T)$. $f_c(T)$ scales with Σ_0 as $f_c(T) \sim \Sigma_0(T, f)^{x_f}$ with x_f as the nonlinearity exponent. By analyzing such experimental data of AC conductance varied by temperature and disorder on a wide variety of disordered systems, we show that x_f has different values at different phases of a disordered system and can be used to identify the existence of different phases exhibited by such systems. Experimental results of nonOhmic conduction, existence of onset frequency $f_c(T)$, and the role of the onset exponent x_f in identifying various phases of disordered systems are systematically analyzed within the framework of scaling formalism and explained with intra-chain conduction and tunneling between conducting grains separated by insulating regions.

1. Introduction

The real part of alternating current conductance $\Sigma(X, f)$ of a disordered system is a function of several physical variables like disorder D, amplitude of ac voltage V, temperature T, frequency f, and magnetic field B [1]. This leads to the possibility that $\Sigma(X, f)$ can be investigated by various measuring paths expressed by the symbol $\Sigma(X, Y)$ [2–5]. This signifies that conductance $\Sigma(X, f)$ is varied by the parameter X keeping f close to zero (this gives rise to Ohmic conductance $\Sigma(X, 0) = \Sigma_0(X) = \Sigma_0$) and probed as a function of frequency f. Except f, X may be D, V, T, f, and B. Such measuring paths indicate that conductance of a disordered system exhibits nonOhmic character i.e. $\Sigma(X, f)$ remains constant to its Ohmic counterpart Σ_0 up to a certain value of f, known as the onset or critical frequency $f_c(X)$ [4]. Beyond $f_c(X)$, $\Sigma(X, f)$ deviates from Σ_0 and increases monotonically with f or may even saturate at higher value of f [4].

Investigation of $\Sigma(X, f)$ in a wide variety of disordered systems in two or three dimensions indicates a strong similarity in its characteristic features and is referred as a "universal" property of dielectric materials in general [6]. This dispersive behavior of ac conductance pertains to a common scaling description [3,4,7]. A number of such scaling formalisms have been suggested in literature to scale $\Sigma(X, f)$ data with different degrees of success and can be expressed in the following general form [3,8–11]:

$$\frac{\Sigma(X, f)}{\Sigma(X, 0)} = \frac{\Sigma(X, f)}{\Sigma_0} = g\left(\frac{f}{f_c(X)}\right), \quad (1)$$

where $g(y)$ is a scaling function. For $f < f_c(X)$, the scaling function $g(y) \approx 1$ corresponds to the fact that $\Sigma(X, f)$ increases very little from Σ_0. At larger frequency $f \geq f_c(X)$, $g(y) \geq 1$. Thus, $f_c(X)$ separates the Ohmic region from the nonOhmic one along the frequency axis and can also be called a crossover (characteristic) frequency. $f_c(X)$ sets the frequency scale for nonOhmic alternating current conduction in disordered systems [3,4] and has different expressions in different scaling formalisms [4,8,10,11]. Taylor [8] first discovered universality in alternating current conduction in ion conducting oxide glasses by demonstrating the fact that the dielectric loss for different glasses fell on a single curve against scaled frequency. Later Isard [8] used $f_c = \Sigma_0/C$ to achieve the master curve of ac conduction. C is some constant. Eq. (1) with $f_c = \Sigma_0/C$ is referred to as "Taylor-Isard scaling" and has been used by many authors in a wide variety of disordered systems with C being proportional to $1/T$. J. C. Dyre et al. [9] successfully applied the scaling formalism given by Eq. (1) with $f_c = \Sigma_0 T$ or $\frac{\Sigma_0 k_B T}{e^2}$ to demonstrate the universality of ac conduction in different ion conducting oxide glasses. Roling et al. [10] also showed that Eq. (1) with $f_c = \Sigma_0 T$ holds good in achieving the scaling of ac conductivity data at different temperatures of alkali borate glasses $(Na_2O)_x(B_2O_3)_{1-x}$ with fixed x but the same scaling is not valid for samples with different x at a fixed T. To include the concentration of a particular component in a disordered sample, Roling et al. [10] proposed an improved version of the scaling law with $f_c = \Sigma_0 T/x$ which did indeed collapse the

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Original Contribution | Published: 11 July 2019

A Proposal to Adjust the Time-Keeping Systems for Savings in Cycling Operation and Carbon Emission

Amlan Chakrabarti & Krishnendu Chakrabarty

Journal of The Institution of Engineers (India): Series B
100, 541–550 (2019)

Abstract

With the spread of the power transmission networks to thousands of kilometres, the integrated power grid in many countries cover multiple hours in terms of solar position. We present a general mathematical model with multiple time-keeping systems for flattening the electrical load curve in a territory having integrated power grid operations. The multiple time-keeping system areas are set up as a function of both electrical power demand and mean geographical position in longitude. Fluctuation in load results in cycling operation of coal/gas power plants and enhanced carbon emission. In this paper, an attempt is made to quantify the savings in cycling of electrical power

Original Article | Published: 25 October 2019

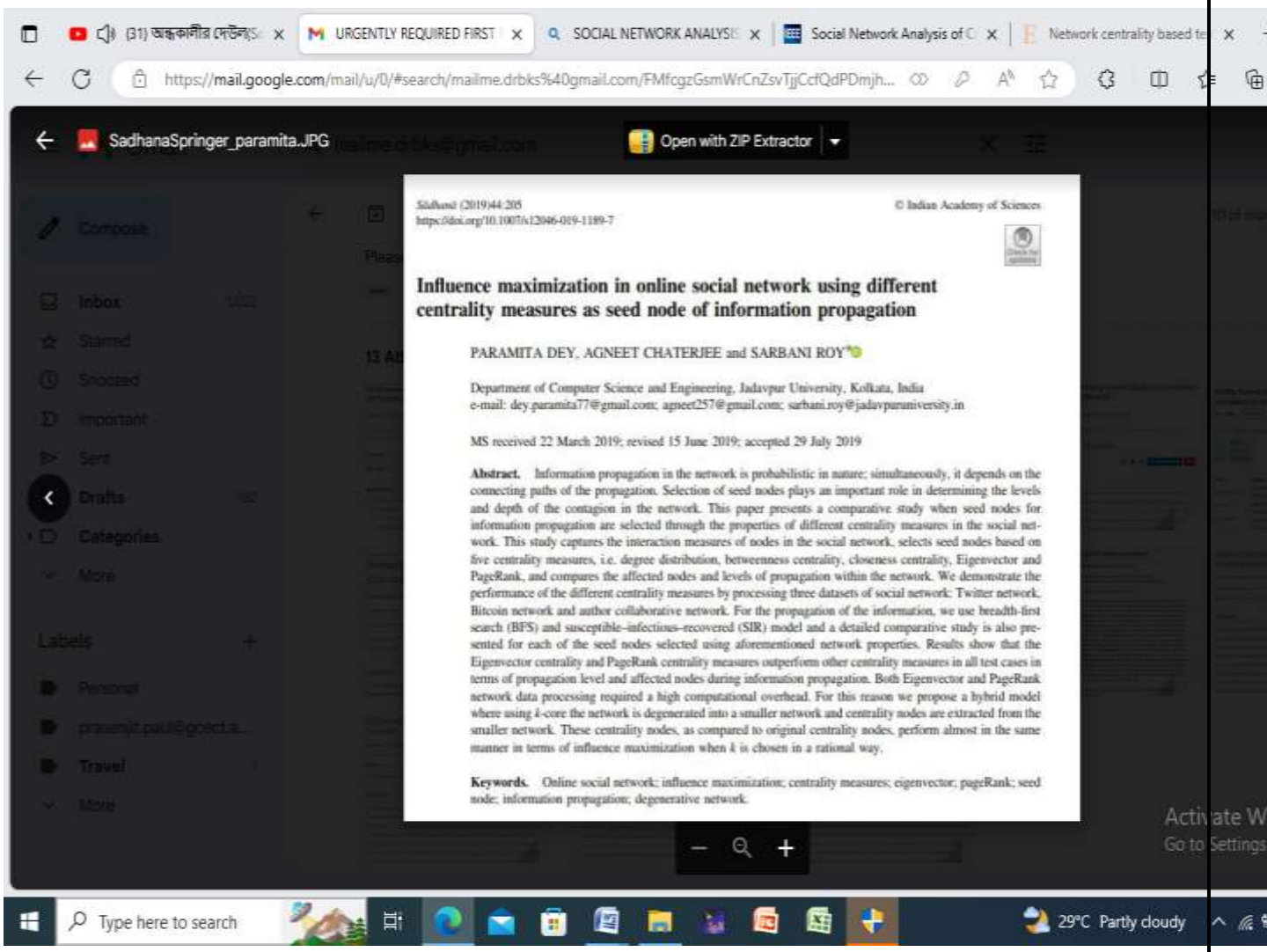
An efficient wavelet and curvelet-based PET image denoising technique

Abhishek Bal ✉, Minakshi Banerjee, Punit Sharma & Mausumi Maitra

Medical & Biological Engineering & Computing **57**, 2567–2598 (2019) | Cite this article

Abstract

Positron emission tomography (PET) image denoising is a challenging task due to the presence of noise and low spatial resolution compared with other imaging techniques such as magnetic resonance imaging (MRI) and computed tomography (CT). PET image noise can hamper further processing and analysis, such as segmentation and disease screening. The wavelet transform–based techniques have often been proposed for PET image denoising to handle isotropic (smooth details) features. The curvelet transform–based PET image denoising techniques have the ability to handle multi-scale and multi-directional properties such as edges and curves (anisotropic features) as compared with wavelet transform–based denoising techniques. The wavelet denoising method is not optimal for anisotropic features, whereas the curvelet denoising method sometimes has difficulty in handling isotropic features.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Influence maximization in online social network using different centrality measures as seed node of information propagation
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Abstract. Information propagation in the network is probabilistic in nature; simultaneously, it depends on the connecting paths of the propagation. Selection of seed nodes plays an important role in determining the levels and depth of the contagion in the network. This paper presents a comparative study when seed nodes for information propagation are selected through the properties of different centrality measures in the social network. This study captures the interaction measures of nodes in the social network, selects seed nodes based on five centrality measures, i.e. degree distribution, betweenness centrality, closeness centrality, Eigenvector and PageRank, and compares the affected nodes and levels of propagation within the network. We demonstrate the performance of the different centrality measures by processing three datasets of social network: Twitter network, Bitcoin network and author collaborative network. For the propagation of the information, we use breadth-first search (BFS) and susceptible–infectious–recovered (SIR) model and a detailed comparative study is also presented for each of the seed nodes selected using aforementioned network properties. Results show that the Eigenvector centrality and PageRank centrality measures outperform other centrality measures in all test cases in terms of propagation level and affected nodes during information propagation. Both Eigenvector and PageRank network data processing required a high computational overhead. For this reason we propose a hybrid model where using k-core the network is degenerated into a smaller network and centrality nodes are extracted from the smaller network. These centrality nodes, as compared to original centrality nodes, perform almost in the same manner in terms of influence maximization when k is chosen in a rational way.
Keywords. Online social network; influence maximization; centrality measures; eigenvector; pageRank; seed node; information propagation; degenerative network.
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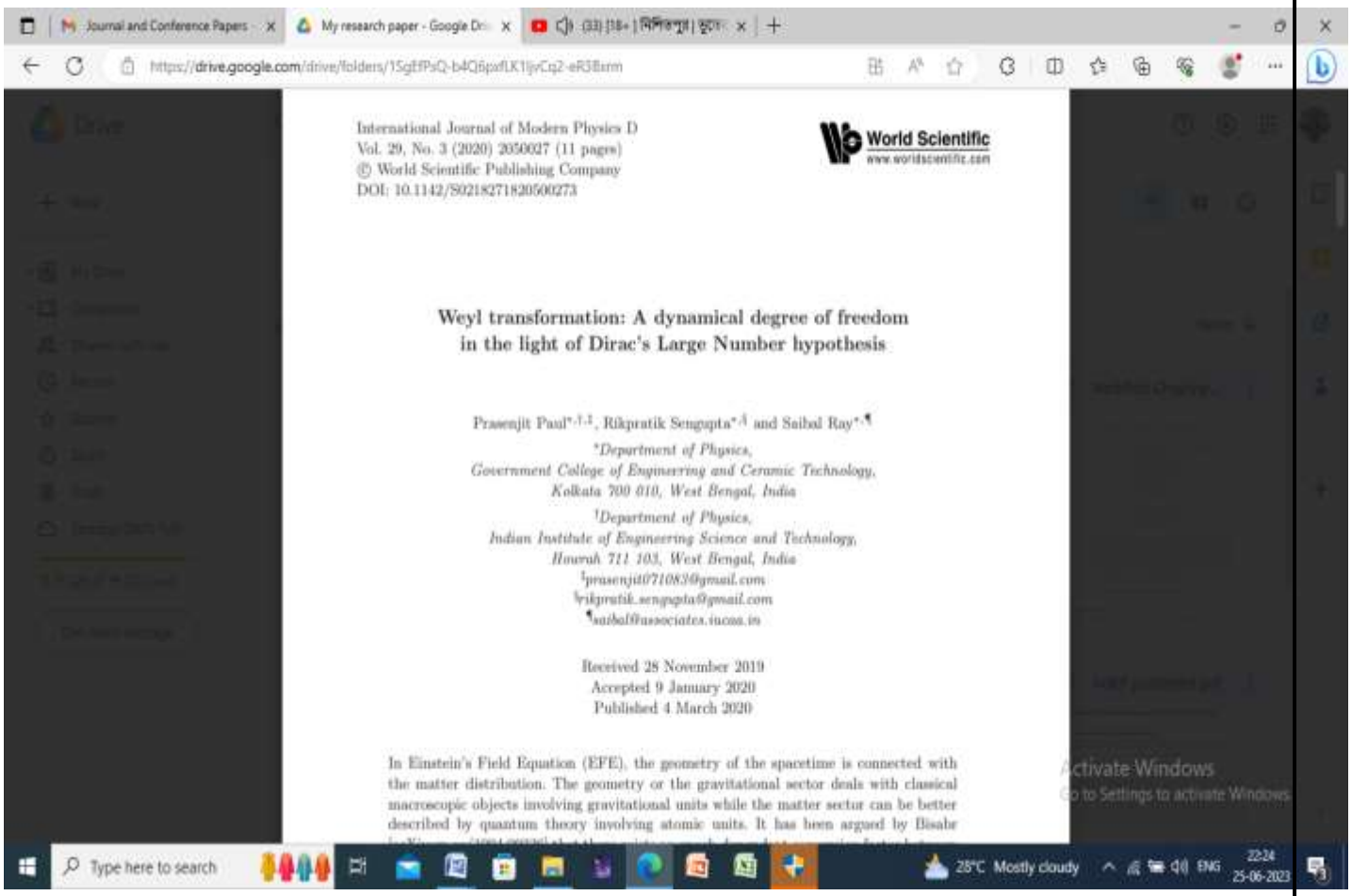

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Weyl transformation: A dynamical degree of freedom in the light of Dirac's Large Number hypothesis

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In Einstein's Field Equation (EFE), the geometry of the spacetime is connected with the matter distribution. The geometry or the gravitational sector deals with classical macroscopic objects involving gravitational units while the matter sector can be better described by quantum theory involving atomic units. It has been argued by Bisabr

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Power system fault identification and localization using multiple linear regression of principal component distance indices

Alok Mukherjee[1], Palash Kr. Kundu[2], Arabinda Das[3]
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ABSTRACT

This paper is focused on the application of principal component analysis (PCA) to classify and localize power system faults in a three phase, radial, long transmission line using receiving end line currents taken almost at the midpoint of the line length. The PCA scores are analyzed to compute principal component distance index (PCDI) which is further analyzed using a ratio based analysis to develop ratio index matrix (R) and ratio error matrix (RE) and ratio error index (REI) which are used to develop a fault classifier, which produces a 100% correct prediction. The later part of the paper deals with the development of a fault localizer using the same PCDI corresponding to six intermediate training locations, which are analyzed with tool like multiple linear regression (MLR) in order to predict the fault location with significantly high accuracy of only 87 m for a 150 km long radial transmission line.

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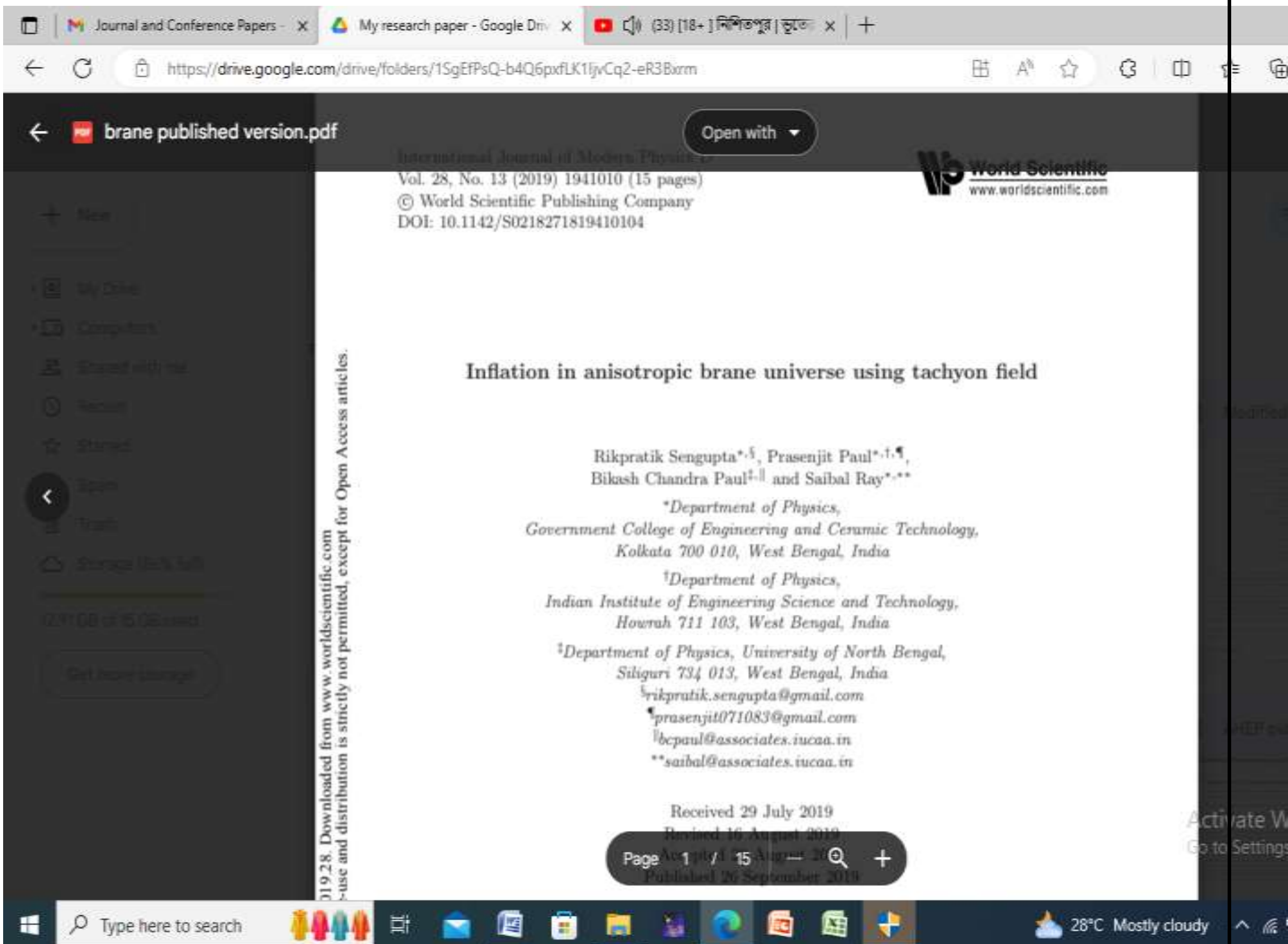

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Inflation in anisotropic brane universe using tachyon field

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Bikash Chandra Paul‡,‖ and Saibal Ray*,**

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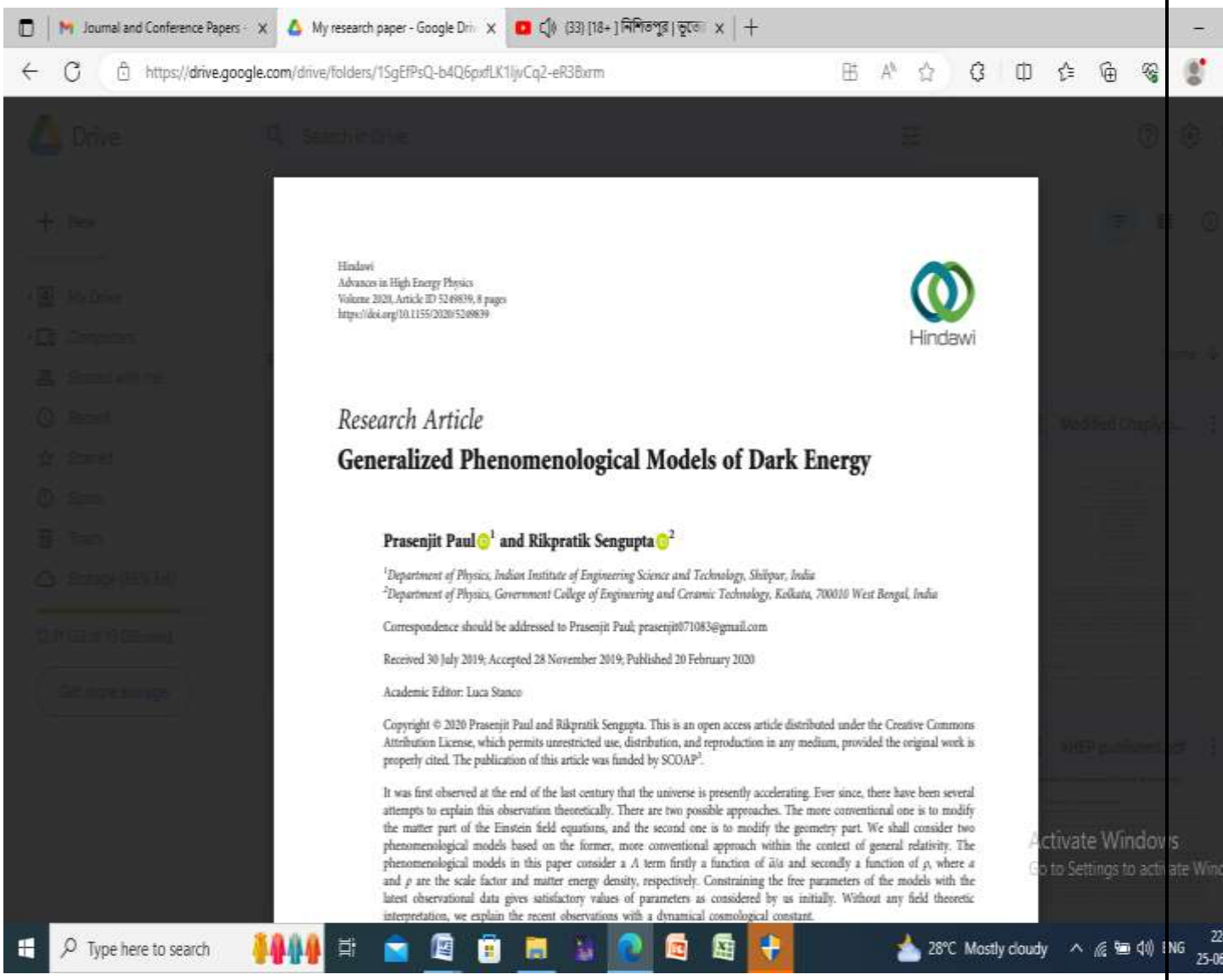

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Advances in High Energy Physics
Volume 2020, Article ID 5249839, 8 pages
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Research Article

Generalized Phenomenological Models of Dark Energy

Prasenjit Paul[1] **and Rikpratik Sengupta**[2]

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Academic Editor: Luca Stanco

It was first observed at the end of the last century that the universe is presently accelerating. Ever since, there have been several attempts to explain this observation theoretically. There are two possible approaches. The more conventional one is to modify the matter part of the Einstein field equations, and the second one is to modify the geometry part. We shall consider two phenomenological models based on the former, more conventional approach within the context of general relativity. The phenomenological models in this paper consider a Λ term firstly a function of $\ddot{a}/a$ and secondly a function of ρ, where a and ρ are the scale factor and matter energy density, respectively. Constraining the free parameters of the models with the latest observational data gives satisfactory values of parameters as considered by us initially. Without any field theoretic interpretation, we explain the recent observations with a dynamical cosmological constant.

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ORIGINAL PAPER
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Bias Exponent of Resistance Noise as a Probe for Disordered Systems

Animesh Kr. Dey, Upendranath Nandi, Deep Talukdar, Rajkumar Chakrabarty, and Kamal Kumar Bardhan*

The power spectral density $S_V(f)$ of voltage fluctuations in the Ohmic regime of a system varies with voltage V as $S_V(f) \propto V^\beta$ where β is the bias exponent. The equilibrium resistance fluctuation in a homogeneous system provides $\beta = 2$ but in disordered systems, we show that β strongly depends on quenched disorder and temperature and is less than 2 in the Ohmic region. At a fixed temperature, β remains nearly equal to 2 at low disorder and decreases from 2 to 1 with the increase in disorder. Interestingly, similar variation in β is observed with the change in temperature from high to low at a fixed quenched disorder. These two cases favor weak localization in the limit of high disorder or low temperature. Experimental results on manganite compounds indicate that the bias exponent β could be used as a sensible nondestructive parameter to identify the existence of a phase transition evolved during the course of investigation. Remarkable correlations between the electrical transport and the power spectral density $S_V(f)$ are observed and explained with the help of inhomogeneous distribution of currents. The results are also supported by the non-Gaussian nature of the second spectrum of $1/f$ noise at different temperatures.

1. Introduction

Resistance noise is one of the most ubiquitous and generic phenomenon occurring in diverse classes of materials ranging from homogeneous to inhomogeneous in condensed matter physics.[1–4] In recent times, there has been many-fold increase in using the resistance noise as a tool to probe transport mechanism in complex systems such as solid-state devices,[5] composites,[6–8] multiwall carbon nanotubes in HDPE matrix,[9] conducting polymers,[7] biological films,[10] organic conductors,[11] manganites,[12] thin films of manganites,[13,14] ultrathin Cu film,[15] and photovoltaic perovskite solar cells.[16] A fundamental assumption of the resistance fluctuation is that it is an intrinsic property unaffected by the current flowing through the system.[2] Under this assumption the power spectral density $S_V(f)$ in the Ohmic regime has the expression,

$$S_V(f) = \frac{aV^\beta}{Nf^\gamma}, \tag{1}$$

where N stands for the total number of charge carriers and a is the dimensionless Hooge parameter. V is the average dc voltage across the sample and γ is the frequency exponent varying between 0.8 and 1.2. The parameter β in Eq. (1) is known as the bias exponent with a value 2 in homogeneous systems in the Ohmic region. Such a relation is experimentally observed in a wide variety of disordered systems.[3,5,11,12]

If the fluctuation in voltage is affected by the current flowing through the sample, the square of such voltage fluctuations in the Ohmic regime can be written as,

$$(\delta V)^2 = I^2(\delta R)^2 \propto I^\beta$$
$$\text{or} \qquad (\delta R)^2 \propto I^{\beta-2}. \tag{2}$$

Equation (2) indicates that $\beta = 2$ is an identity arising out of the assumption that the inherent resistance fluctuations independent of any driving force such as current or voltage are always there but a constant current or voltage is used to make the fluctuations visible. On the contrary, $\beta \neq 2$ in the Ohmic region has a significant implication in that the current or voltage is not a mere probe but takes active part in the mechanism of generation of fluctuation. In the Ohmic region, such reports exist in the weak localization region at low temperature or at high disorder limit[13,15] and indicate that β is a function of quenched disorder[13,15] and temperature.[13,16,17] Except in Barone et al.,[13] no concrete physical reasoning or mathematical modeling has been invoked to explain the variation of β with quenched

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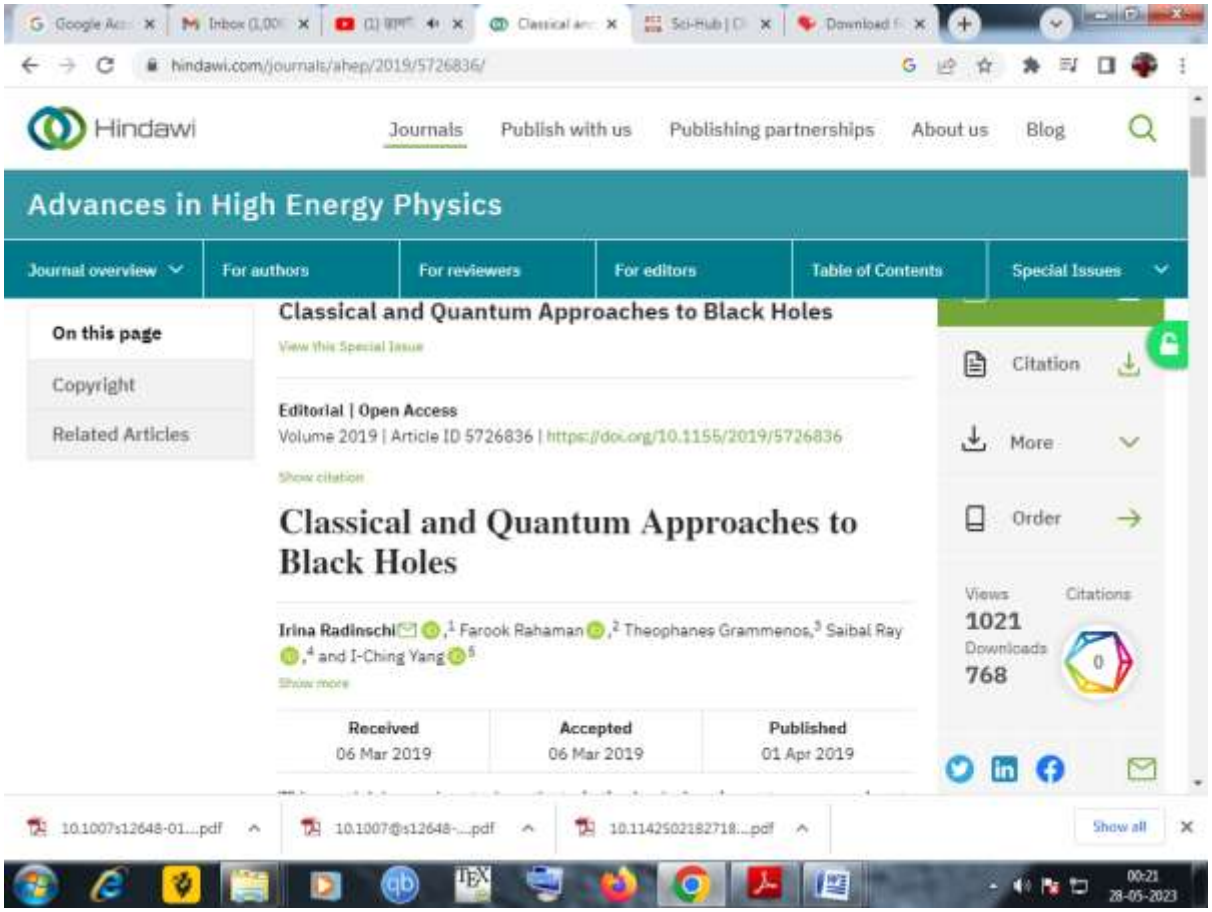
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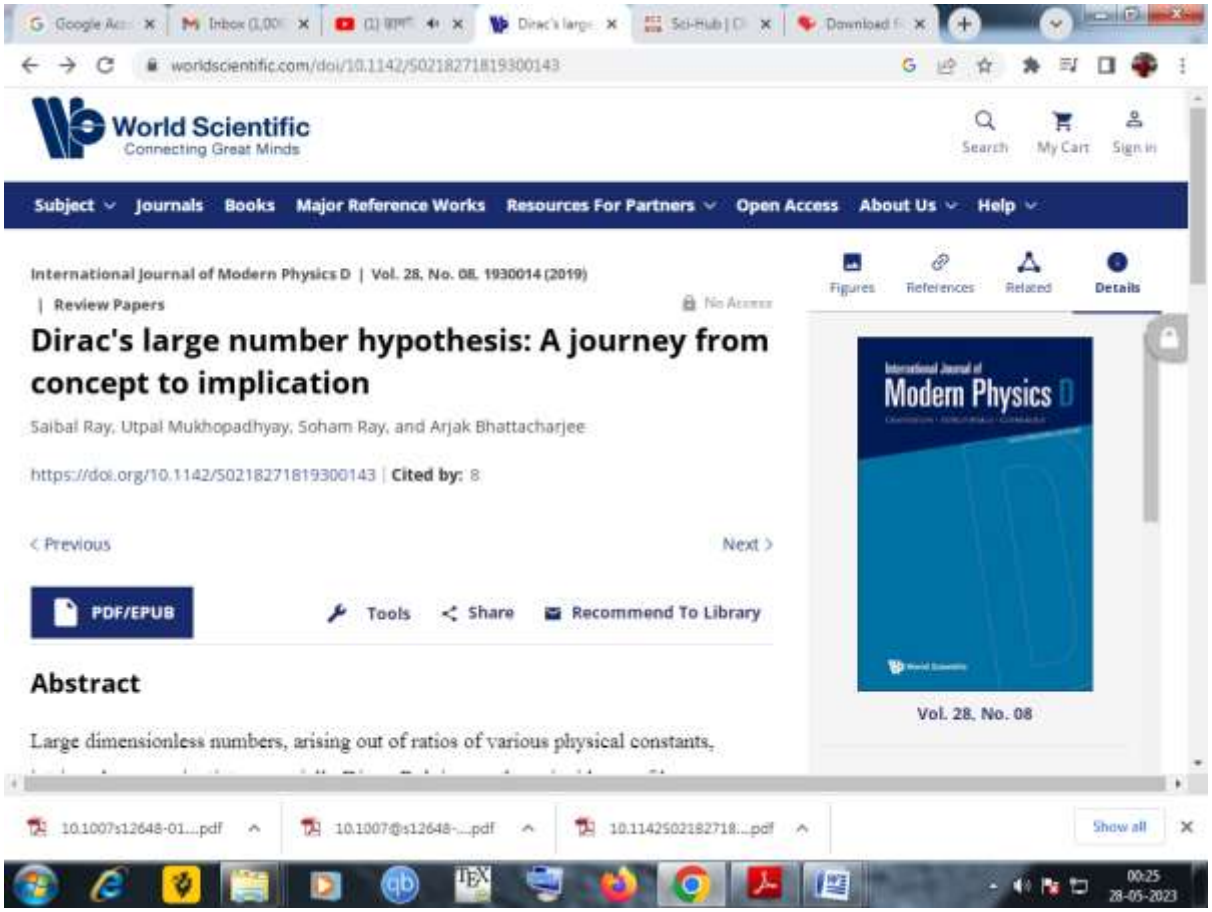
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Charged anisotropic strange stars in Finslerian geometry

Sourav Roy Chowdhury, Debabrata Deb, Saibal Ray, Farook Rahaman & B. K. Guha

The European Physical Journal C 79, Article number: 547 (2019) | Cite this article

Abstract

We investigate a simplified model of the strange stars in the framework of Finslerian geometry, composed of charged fluid. It is considered that the fluid consisting of three flavor quarks including a small amount of non-interacting electrons to maintain the chemical equilibrium and assumed that the fluid is compressible by nature. To obtain the simplified form of

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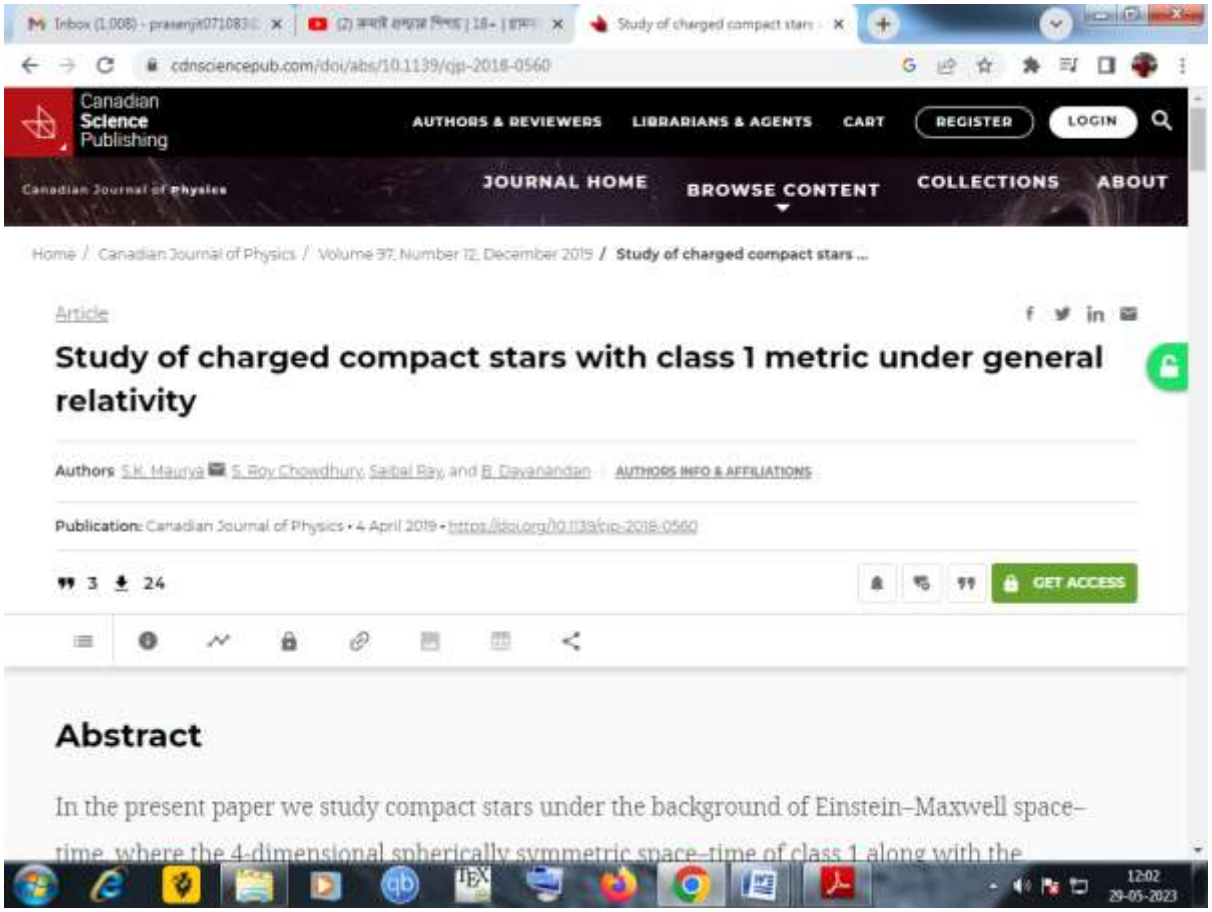
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Article
Study of charged compact stars with class 1 metric under general relativity
Authors S.K. Maurya, S. Roy Chowdhury, Saibal Ray, and B. Dayanandan
AUTHORS INFO & AFFILIATIONS
Publication: Canadian Journal of Physics • 4 April 2019 • https://doi.org/10.1139/cjp-2018-0560
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Abstract
In the present paper we study compact stars under the background of Einstein–Maxwell space–time, where the 4-dimensional spherically symmetric space–time of class 1 along with the
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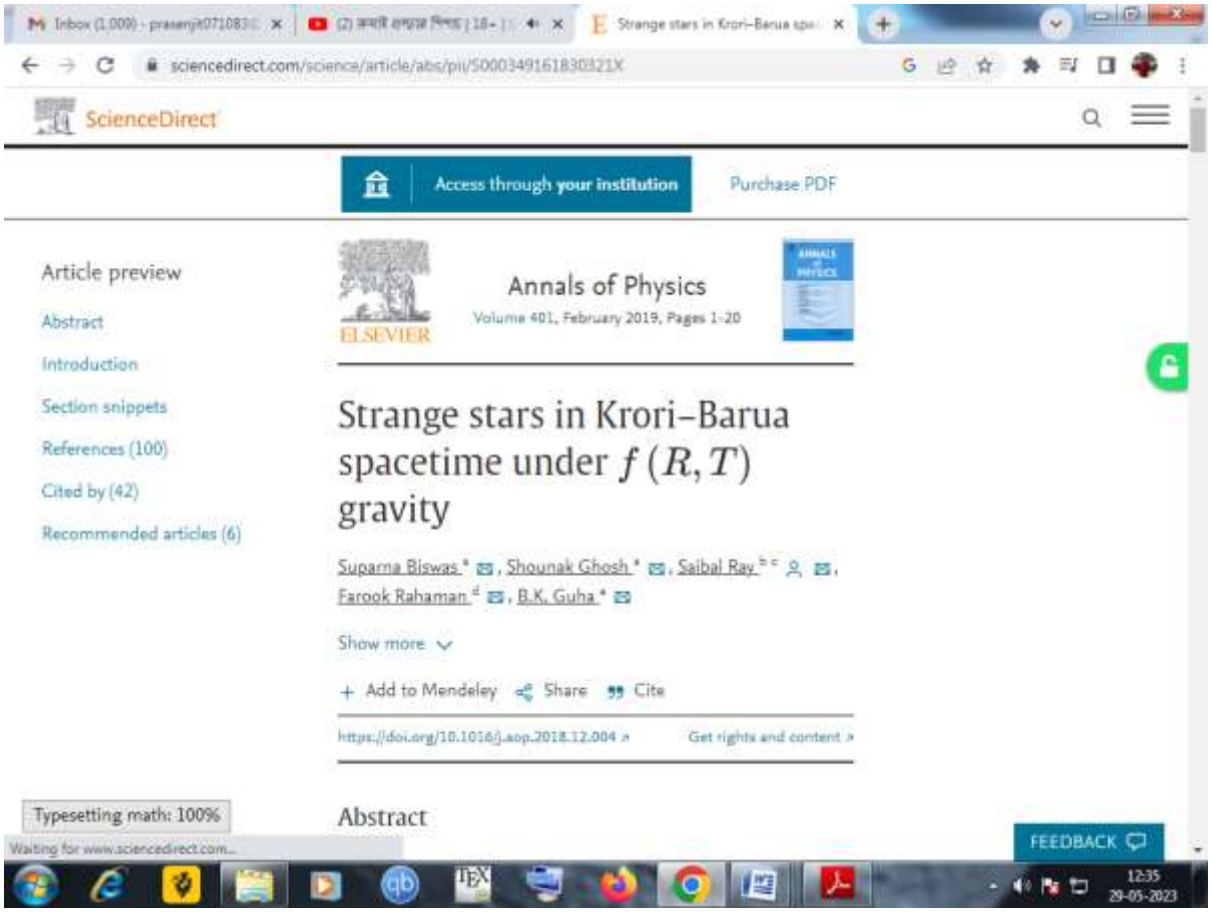
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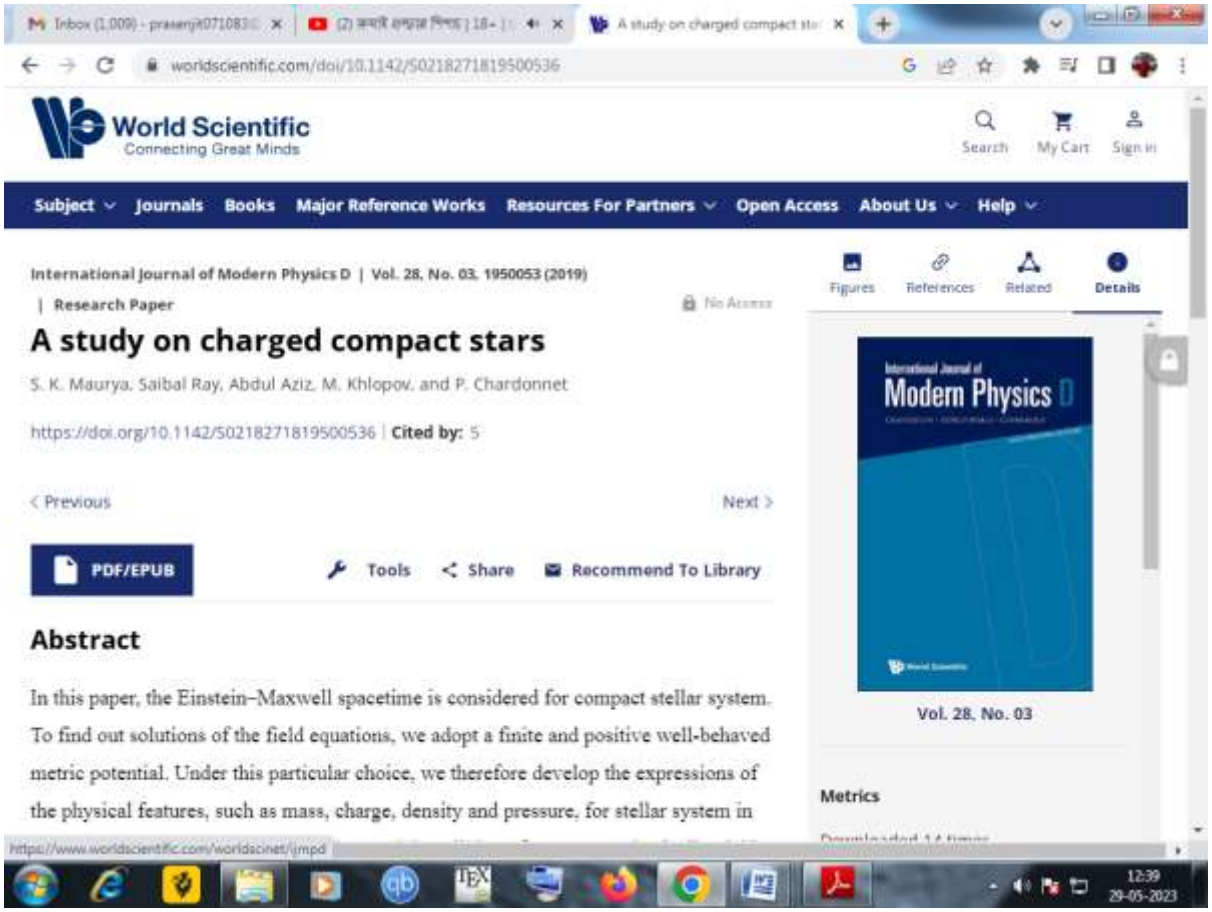
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Abstract
In this paper, the Einstein–Maxwell spacetime is considered for compact stellar system. To find out solutions of the field equations, we adopt a finite and positive well-behaved metric potential. Under this particular choice, we therefore develop the expressions of the physical features, such as mass, charge, density and pressure, for stellar system in
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General Relativity and Gravitation (2018) 50:112
https://doi.org/10.1007/s10714-018-2434-9

RESEARCH ARTICLE

A new model for strange stars

Debabrata Deb[1] · Sourav Roy Chowdhury[1] · Saibal Ray[2] · Farook Rahaman[3]

Received: 6 March 2018 / Accepted: 6 August 2018

Abstract

In the present work, we attempt to find a new class of solutions for the spherically symmetric perfect fluid sphere by employing the homotopy perturbation method (HPM), a new tool via which the mass polynomial function facilitates to tackle the Einstein field equations. A set of interior solutions found on the basis of the simplest MIT bag model equation of state in the form $p = \frac{1}{3}(\rho - 4B)$ where B is the bag constant. The proposed interior metric for the stellar system is consistent with the exterior Schwarzschild spacetime on the boundary. In addition, we also conduct a detailed study on different tests, viz. the energy conditions, TOV equation, adiabatic index, Buchdahl limit, etc., to verify the physical validity of the proposed model. The numerical value of the used parameters are predicted for different strange star candidates, for different chosen values of the bag constant. In a nutshell, by exploiting HPM technique first time ever in the field of relativistic astrophysics, we have predicted in the present literature a singularity-free and stable stellar model which is suitable to describe ultra-dense objects, like strange (quark) stars.

Keywords General relativity · Homotopy perturbation method · Strange stars

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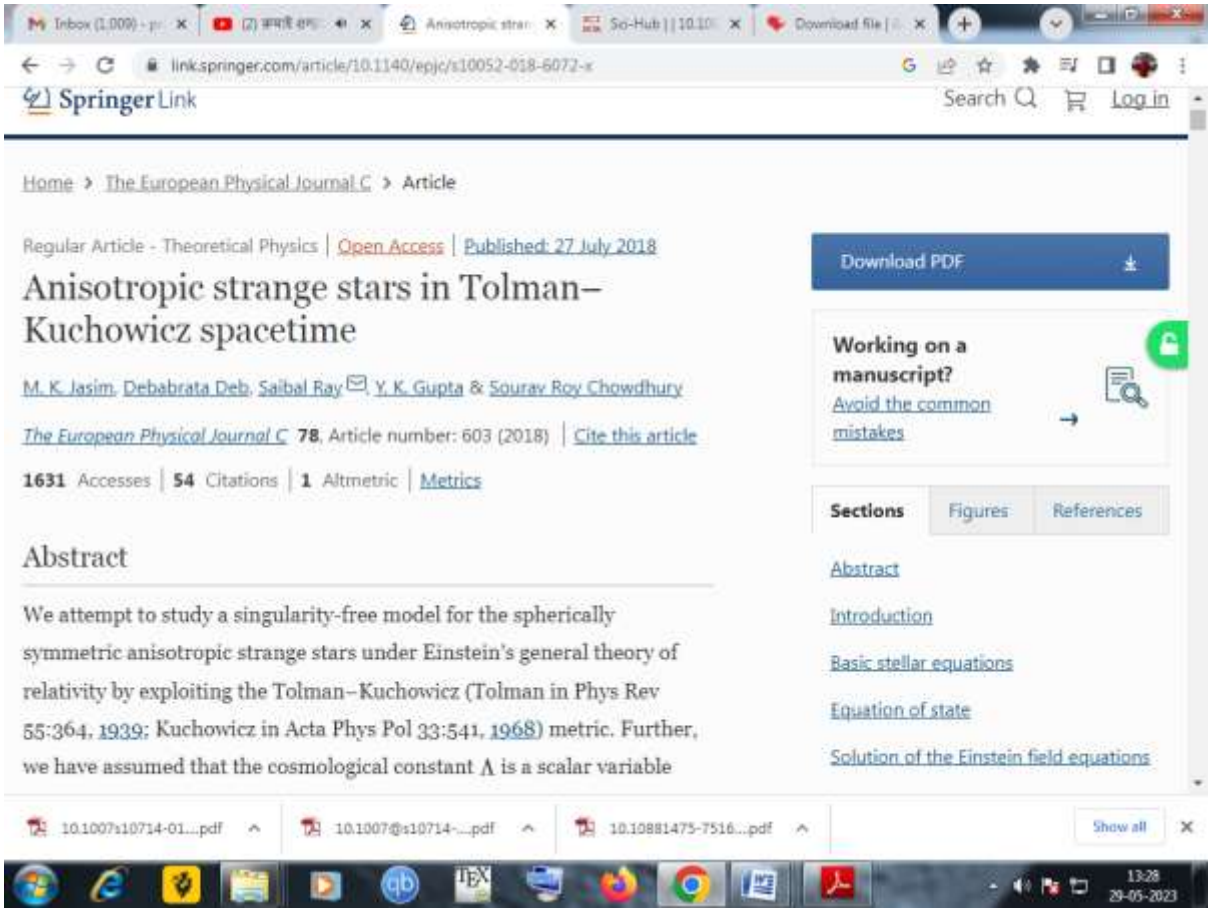
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Anisotropic strange stars in Tolman–Kuchowicz spacetime
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The European Physical Journal C 78, Article number: 603 (2018) | Cite this article
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Abstract
We attempt to study a singularity-free model for the spherically symmetric anisotropic strange stars under Einstein's general theory of relativity by exploiting the Tolman–Kuchowicz (Tolman in Phys Rev 55:364, 1939; Kuchowicz in Acta Phys Pol 33:541, 1968) metric. Further, we have assumed that the cosmological constant Λ is a scalar variable
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Exploring physical features of anisotropic strange stars beyond standard maximum mass limit in $f(R,T)$ gravity
Debabrata Deb, Sergei V Ketov, S K Maurya, Maxim Khlopov, P H R S Moraes, Saibal Ray
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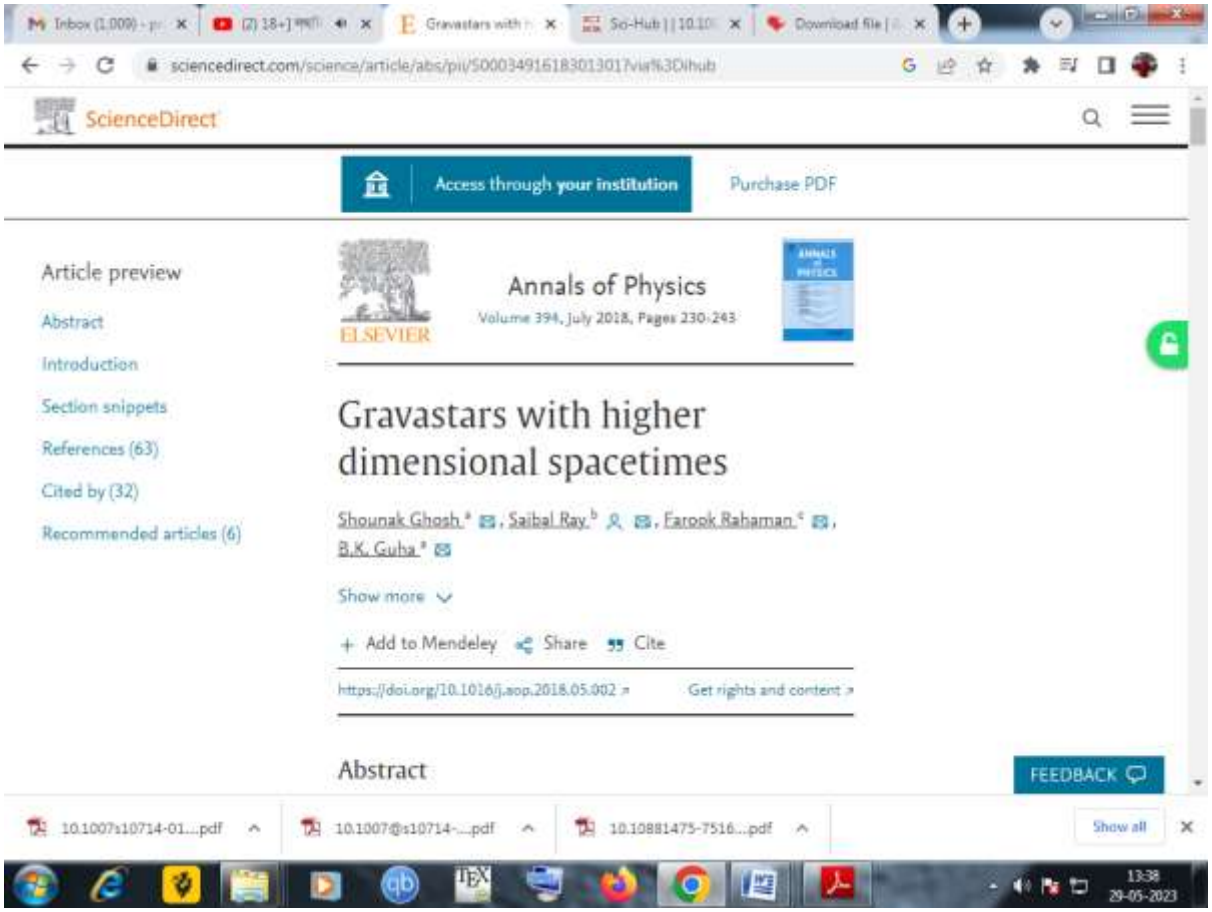
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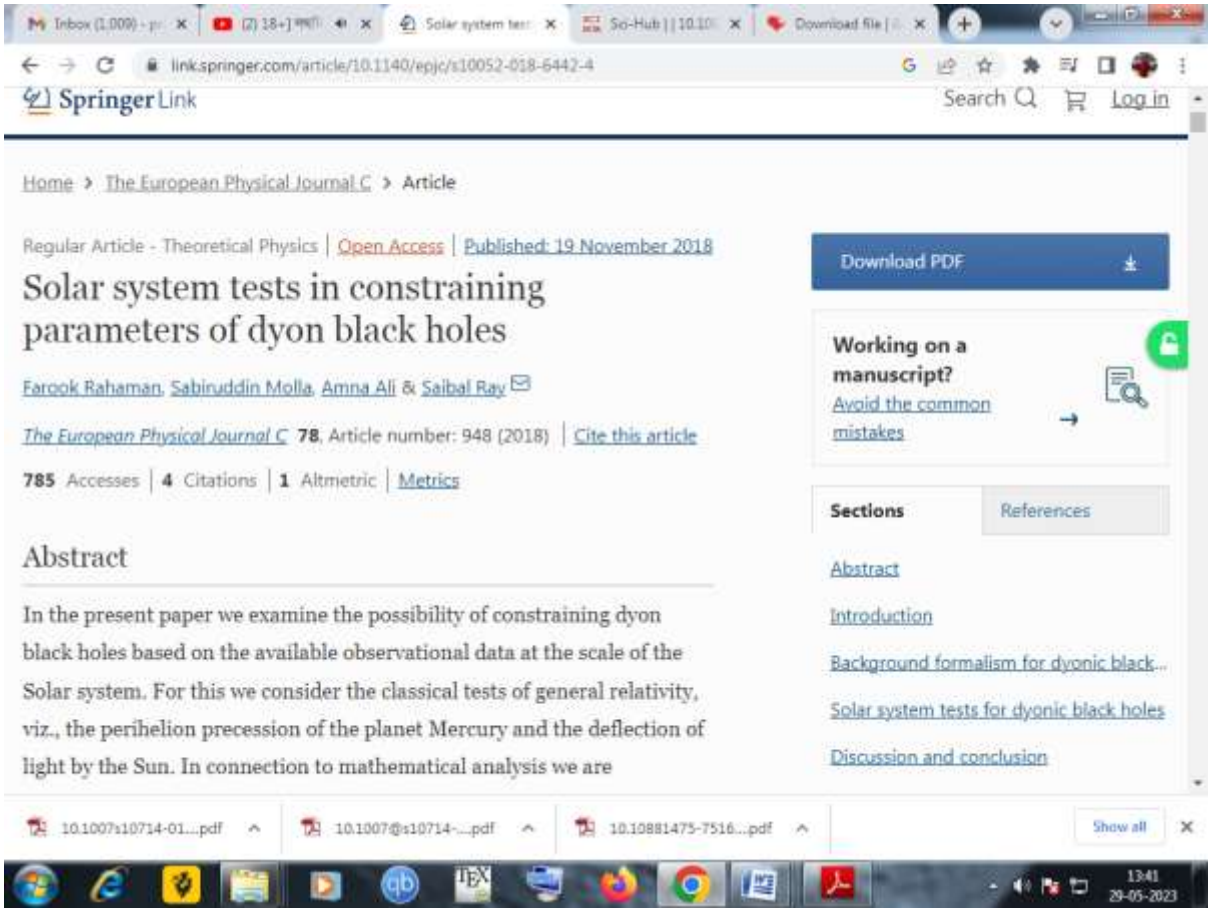
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Solar system tests in constraining parameters of dyon black holes
Farook Rahaman, Sabiruddin Molla, Amna Ali & Saibal Ray
The European Physical Journal C 78, Article number: 948 (2018) | Cite this article
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Abstract
In the present paper we examine the possibility of constraining dyon black holes based on the available observational data at the scale of the Solar system. For this we consider the classical tests of general relativity, viz., the perihelion precession of the planet Mercury and the deflection of light by the Sun. In connection to mathematical analysis we are
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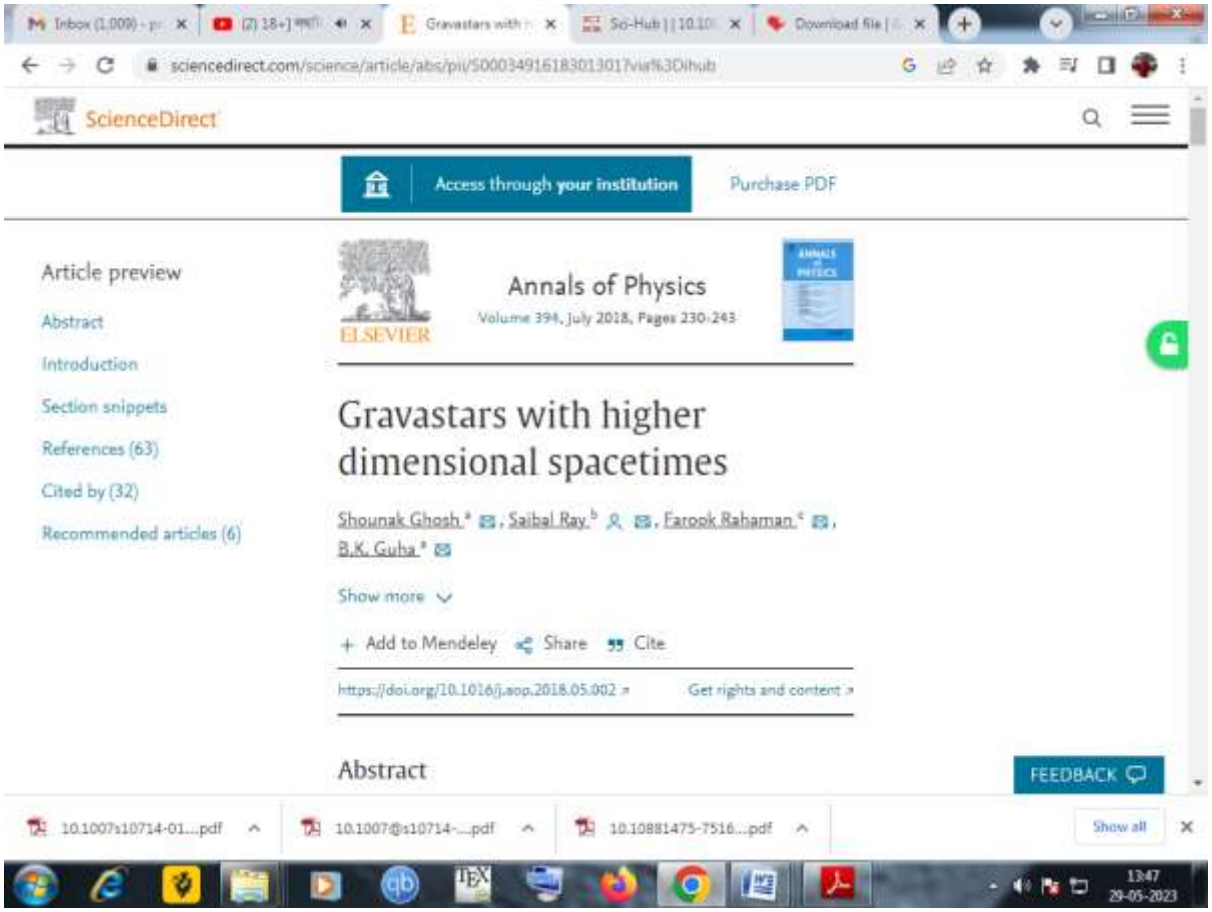
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IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-5, May 2019 E-ISSN: 2347-2693

A Study and Analysis of Lock and STM Overheads

Ryan Saptarshi Ray[1*], Parama Bhaumik[2], Utpal Kumar Ray[3]

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Accepted: 18/May/2019, Published: 31/May/2019

Abstract— In this paper we make a comparative study of the overheads of locks and STM by taking different practical synchronization problems as examples to understand why the performance of STM is worse than that of locks. Overhead is the combination of excess or indirect computation time, memory, bandwidth, or other resources that are required to perform a specific task. While executing parallel programs whenever any lock or STM function is called it takes some time and also occupies some space. The total time taken by all the lock or STM calls of the program is the total lock or STM time overhead of that program. The total space occupied by all the lock or STM calls of the program is the total lock or STM space overhead of that program. The flexible approach is an approach of programming with STM by which STM has been made more user-friendly and by which execution time of STM has been reduced. We make a study of the overheads of the flexible approach also. We found that the time and space overheads of STM are higher than that of locks. The time and space overheads of the Flexible Approach were less than those of STM but higher than those of locks.

Keywords— Multiprocessing, Parallel Processing, Locks, Software Transactional Memory, Overheads

I. INTRODUCTION

Overhead is the combination of excess or indirect computation time, memory, bandwidth, or other resources that are required to perform a specific task **[1]**.

Software Transactional Memory (STM) is a new approach for solving synchronization problems in parallel programs that does not suffer from the drawbacks of locks. However performance of STM is either equal to or worse than that of locks. In this paper we make a comparative study of the overheads of locks and STM to understand why this happens.

While executing parallel programs whenever any lock or STM function is called it takes some time and also occupies some space. The total time taken by all the lock or STM calls of the program is the total lock or STM time overhead of that program. The total space occupied by all the lock or STM calls of the program is the total lock or STM space overhead of that program.

The flexible approach is an approach of programming with STM by which STM has been made more user-friendly and by which execution time of STM has been reduced. We make a study of the overheads of the flexible approach also.

We found that the time and space overheads of STM are higher than that of locks. The time and space overheads for the Flexible Approach were less than those of STM but higher than those of locks.

Section II discusses about different approaches which have been proposed to improve the performance of STM. Section III shows the time overhead for locks and STM for different practical synchronization problems. Section IV shows the space overhead for locks and STM for different practical synchronization problems. Section V shows the time overhead for the Flexible Approach for different practical synchronization problems. Section VI shows the space overhead for the Flexible Approach for different practical synchronization problems. Section VII makes a comparison of the overheads for locks, STM and the Flexible Approach. Section VIII shows the specifications of the system in which the programs were compiled and executed. Section IX concludes the paper.

II. RELATED WORK

Different approaches have been proposed to improve the performance of STM. These are discussed below.

In 2007 Yang Ni, Vijay Menon, Richard L. Hudson, Ali-Reza Adl-Tabatabai, J. Eliot, B. Moss, Bratin Saha, Antony L. Hosking, Tatiana Shpeisman published a paper entitled "Open Nesting in Software Transactional Memory" **[2]**. This paper described new language constructs to support open nesting in Java and also discussed new abstract locking mechanisms that a programmer could use to prevent logical

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Flexible Programming Approach using STM

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Available online at: www.ijcseonline.org

Accepted: 19/July/2018, Published: 31/July/2018

Abstract— Software Transactional Memory (STM) is a promising new approach to programming shared-memory parallel processors which does not suffer from the drawbacks of locks. However STM also has some limitations. One of the limitations of STM is that while programming with STM users have to identify the critical sections explicitly and enclose them in transactions using appropriate STM calls to ensure synchronization. This approach is similar to using locks in parallel programs. This paper introduces a new flexible approach for programming using STM in which users do not need to identify critical sections explicitly. In this approach whenever users need to perform read or write operations they can do so using appropriate STM calls and STM will ensure synchronization by its internal constructs. Thus users can concentrate only on the algorithm of the parallel problem without thinking about synchronization. Thus this approach is very user-friendly. Time taken will also be less than lock programming as users do not have to identify critical sections explicitly.

Keywords— Multiprocessing, Parallel Processing, Locks, Software Transactional Memory, Flexible Programming Approach

I. INTRODUCTION

Ensuring synchronization is a very important aspect of parallel programming. Currently locks are used to ensure synchronization. But locks suffer from some drawbacks. Software Transactional Memory (STM) is a promising new approach to programming shared-memory parallel processors which does not suffer from the drawbacks of locks. But STM also has some limitations. One of the limitations of STM is that while programming with STM users have to identify the critical sections explicitly and enclose them in transactions using appropriate STM calls to ensure synchronization. This approach is similar to using locks in parallel programs where also users have to identify critical sections explicitly and enclose them using appropriate lock calls to ensure synchronization. This paper introduces a new flexible approach for programming using STM in which users do not need to identify critical sections explicitly. In this approach whenever users need to perform read or write operations they can do so using appropriate STM calls and STM will ensure synchronization by its internal constructs. Thus users can concentrate only on the algorithm of the parallel problem without thinking about synchronization. Thus this approach is very user-friendly. Time taken will also be less than lock programming as users do not have to identify critical sections explicitly.

Section III describes the Flexible Programming Approach. Section IV solves the Readers-Writers Problem using the Flexible Programming Approach. Section V shows the experimental results for solving the Readers-Writers Problem using Flexible Programming Approach.

II. RELATED WORK

Different approaches have been proposed to improve the performance of STM. These are discussed below.

In 2007 Yang Ni, Vijay Menon, Richard L. Hudson, Ali-Reza Adl-Tabatabai, J. Eliot, B. Moss, Bratin Saha, Antony L. Hosking, Tatiana Shpeisman published a paper entitled "Open Nesting in Software Transactional Memory". **[1]** This paper presented an implementation of open nested transactions in a Java-based software transactional memory (STM) system. It described new language constructs to support open nesting in Java and also discussed new abstract locking mechanisms that a programmer could use to prevent logical conflicts. It demonstrated how these constructs could be mapped efficiently to existing STM data structures. Finally, it evaluated the system on a set of Java applications and data structures, demonstrating how open nesting could enhance application scalability. In 2009 Zhengyu He and Bo Hong published a paper entitled "Impact of Early Abort Mechanisms on Lock-Based Software Transactional Memory". **[2]** This paper presented a theoretical analysis characterizing the properties of early abort and its impact on the performance of lock-based STMs. Queuing theory was adopted to model the behaviors of transactional execution. Analytical results were obtained for STMs with and without early abort. The analysis was validated through extensive

Short paper | Published: 30 March 2019

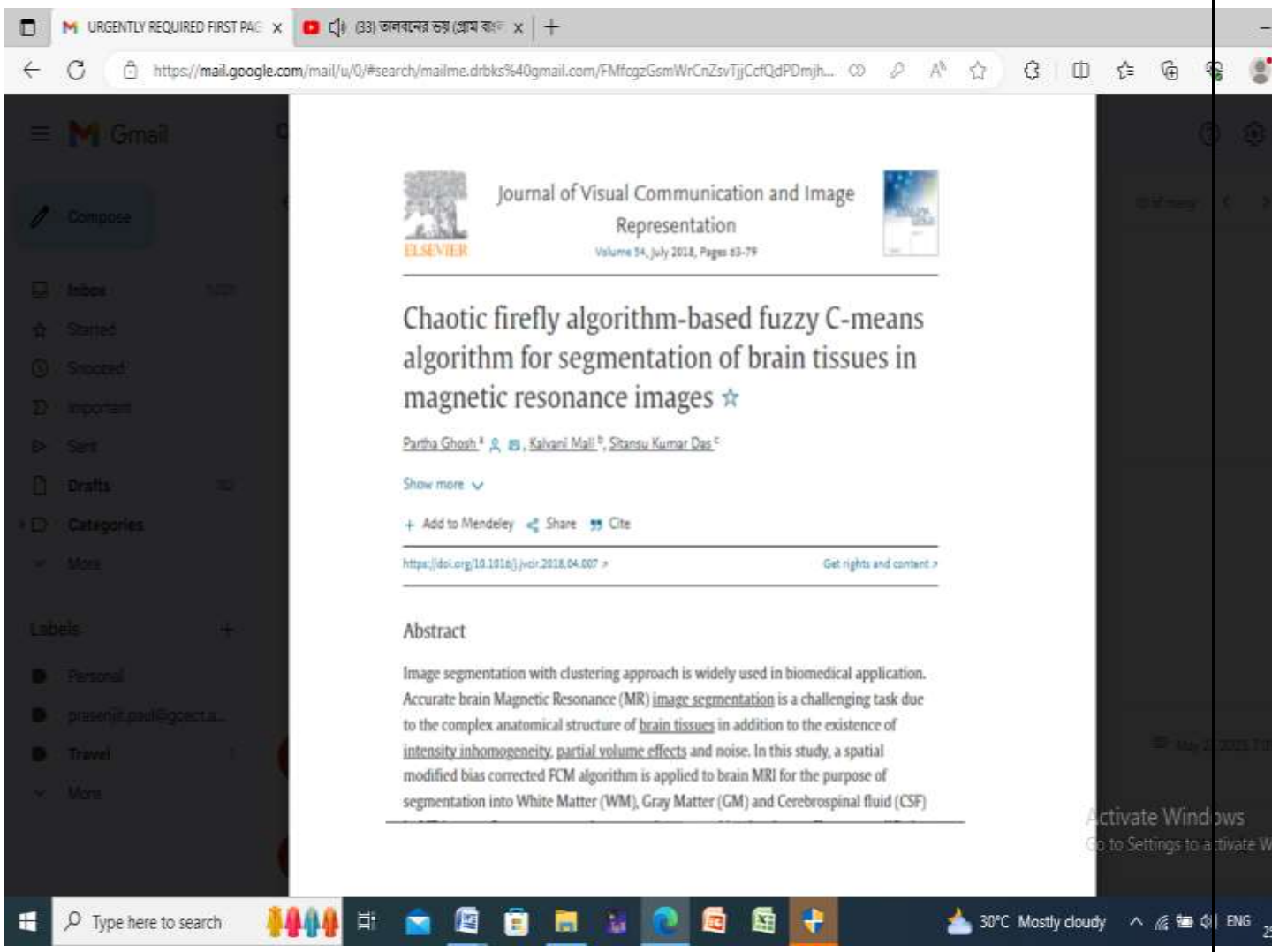
3D unsupervised modified spatial fuzzy *c*-means method for segmentation of 3D brain MR image

Kamarujjaman & Mausumi Maitra

Pattern Analysis and Applications **22**, 1561–1571 (2019) | Cite this article

Abstract

This paper proposed a novel 3D unsupervised spatial fuzzy-based brain MRI volume segmentation technique in the presence of intensity inhomogeneity and noise. Instead of static masking, dynamic 3D masking has been proposed to measure the correlation among neighbors. The local membership function is defined based on the weighted correlation among neighbors. The local and global membership functions are combined to suppress the inhomogeneity and noise at the time of clustering. A weighted function is defined based on the 3D dynamic neighborhood to optimize the objective function in 3D space. In 2D slice-based MRI image segmentation techniques, the selection of the slice of interest is very important and it depends on the experience and skills of the expertise. As the proposed unsupervised method segments the 3D brain MRI volume as a whole, there is no need of such expertise. The detailed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Chaotic firefly algorithm-based fuzzy C-means algorithm for segmentation of brain tissues in magnetic resonance images ☆
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Abstract
Image segmentation with clustering approach is widely used in biomedical application. Accurate brain Magnetic Resonance (MR) image segmentation is a challenging task due to the complex anatomical structure of brain tissues in addition to the existence of intensity inhomogeneity, partial volume effects and noise. In this study, a spatial modified bias corrected FCM algorithm is applied to brain MRI for the purpose of segmentation into White Matter (WM), Gray Matter (GM) and Cerebrospinal fluid (CSF)
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A Simple Approach to Identify Power System Transmission Line Faults using PNN

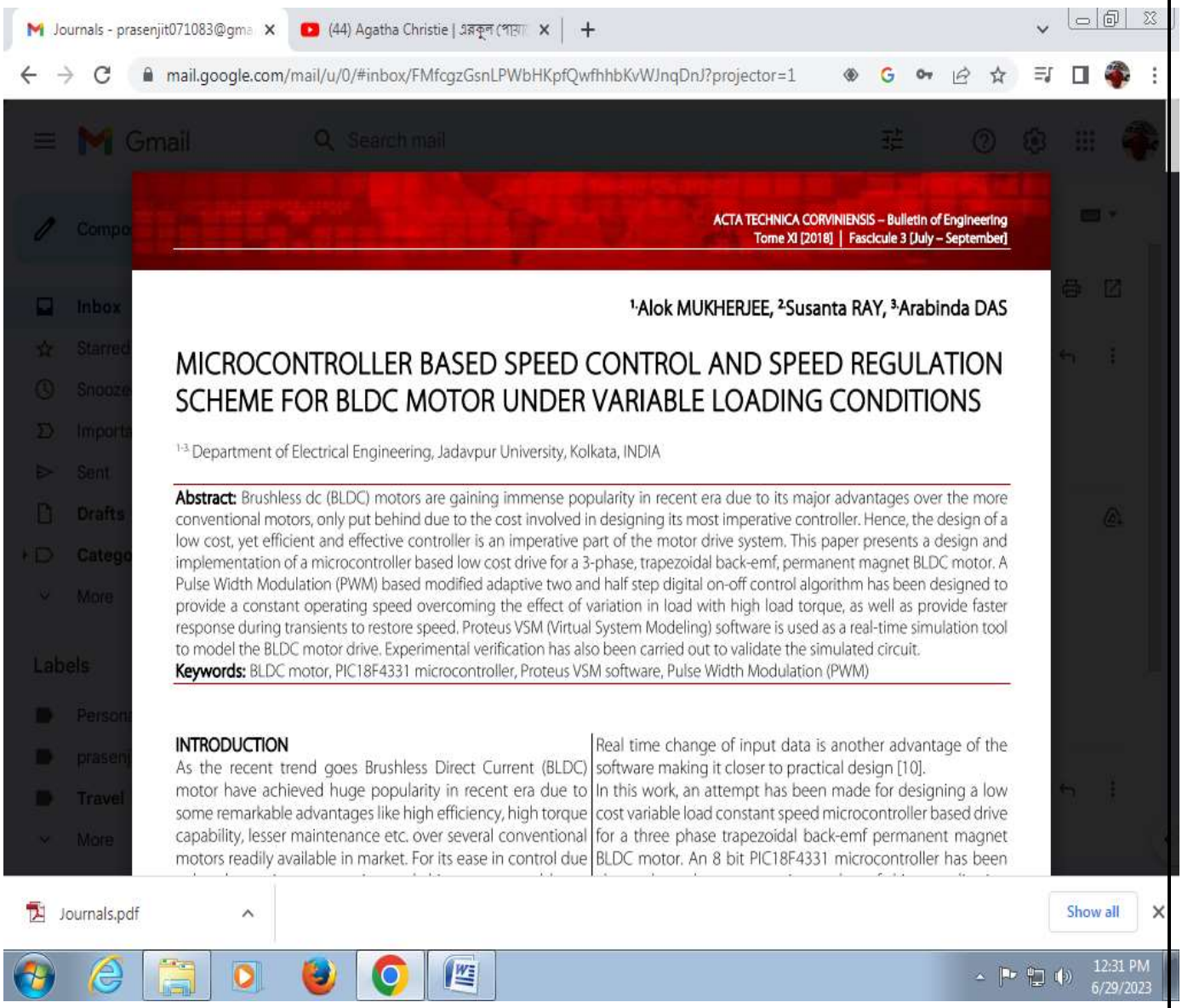
A. Acharya[1], A. Mukherjee[2], S. Jana[3]

Abstract - Large interconnected overhead transmission lines are very often subjected to various types of faults leading to mal-operation or even discontinuity of good quality power flow. Hence, accurate and prompt identification and classification of different power systemfaultshave become one of the major areas of research these days to ensure reliability, protection and system stability.This paper presents a Probabilistic Neural Network (PNN) based simple and novelapproachto distinguish and classify different types of power system faults. Electromagnetic Transient Program (EMTP) simulation software has been used to simulate a frequency dependent model and extract the receiving end voltage data only for various faults carried out at different distances. Only two sets of simulated data corresponding to two different locations are fed directly to the PNN algorithm so designed for training, instead of preprocessing the data by filtering tools like Wavelet Transform, component analysis etc. which is done most commonly, thus requiring lesser computation burden, thus saving time. Experimental verification has been carried out to validate the proposed algorithm.

Index Terms—Probabilistic Neural Network (PNN), Electromagnetic Transient Program (EMTP),

phases. Therefore, quickidentification and classification of faults is of most importance to ensure power system stability and reliability. The proposedresearch work is intended to serve the same purpose, i.e. to detect power system fault, if any, and categorize the fault in different fault types for a 400 kV, three phase, single circuit, 150 km long overhead transmission line.

The primary objective of power system fault analysis is to extract some key features from the fault waveforms using the different identifier techniques and provide these data to the detection mechanism to find the true cause of the fault and restore the normal operation in least possible time.Techniques normally used to develop such power system protection algorithm are Wavelet Transformation based Artificial Neural Network (ANN) analysis, Fuzzy Inference system, Principal Component Analysis (PCA), support vector analysis etc.and differenthybrid models of these individual techniques.The tripping circuit of the circuit breakers and other protective relaying mechanisms are given proper signals at the correct instants during any mal-operation, to interrupt the power flow immediately.Hence, fast and accurate detection of fault along with precise fault location have been practiced by researchers to ensure safety.Researchers have devoted much time for the purpose



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[1]Alok MUKHERJEE, [2]Susanta RAY, [3]Arabinda DAS

MICROCONTROLLER BASED SPEED CONTROL AND SPEED REGULATION SCHEME FOR BLDC MOTOR UNDER VARIABLE LOADING CONDITIONS

[1-3] Department of Electrical Engineering, Jadavpur University, Kolkata, INDIA

Abstract: Brushless dc (BLDC) motors are gaining immense popularity in recent era due to its major advantages over the more conventional motors, only put behind due to the cost involved in designing its most imperative controller. Hence, the design of a low cost, yet efficient and effective controller is an imperative part of the motor drive system. This paper presents a design and implementation of a microcontroller based low cost drive for a 3-phase, trapezoidal back-emf, permanent magnet BLDC motor. A Pulse Width Modulation (PWM) based modified adaptive two and half step digital on-off control algorithm has been designed to provide a constant operating speed overcoming the effect of variation in load with high load torque, as well as provide faster response during transients to restore speed. Proteus VSM (Virtual System Modeling) software is used as a real-time simulation tool to model the BLDC motor drive. Experimental verification has also been carried out to validate the simulated circuit.

Keywords: BLDC motor, PIC18F4331 microcontroller, Proteus VSM software, Pulse Width Modulation (PWM)

INTRODUCTION

As the recent trend goes Brushless Direct Current (BLDC) motor have achieved huge popularity in recent era due to some remarkable advantages like high efficiency, high torque capability, lesser maintenance etc. over several conventional motors readily available in market. For its ease in control due

Real time change of input data is another advantage of the software making it closer to practical design [10].

In this work, an attempt has been made for designing a low cost variable load constant speed microcontroller based drive for a three phase trapezoidal back-emf permanent magnet BLDC motor. An 8 bit PIC18F4331 microcontroller has been

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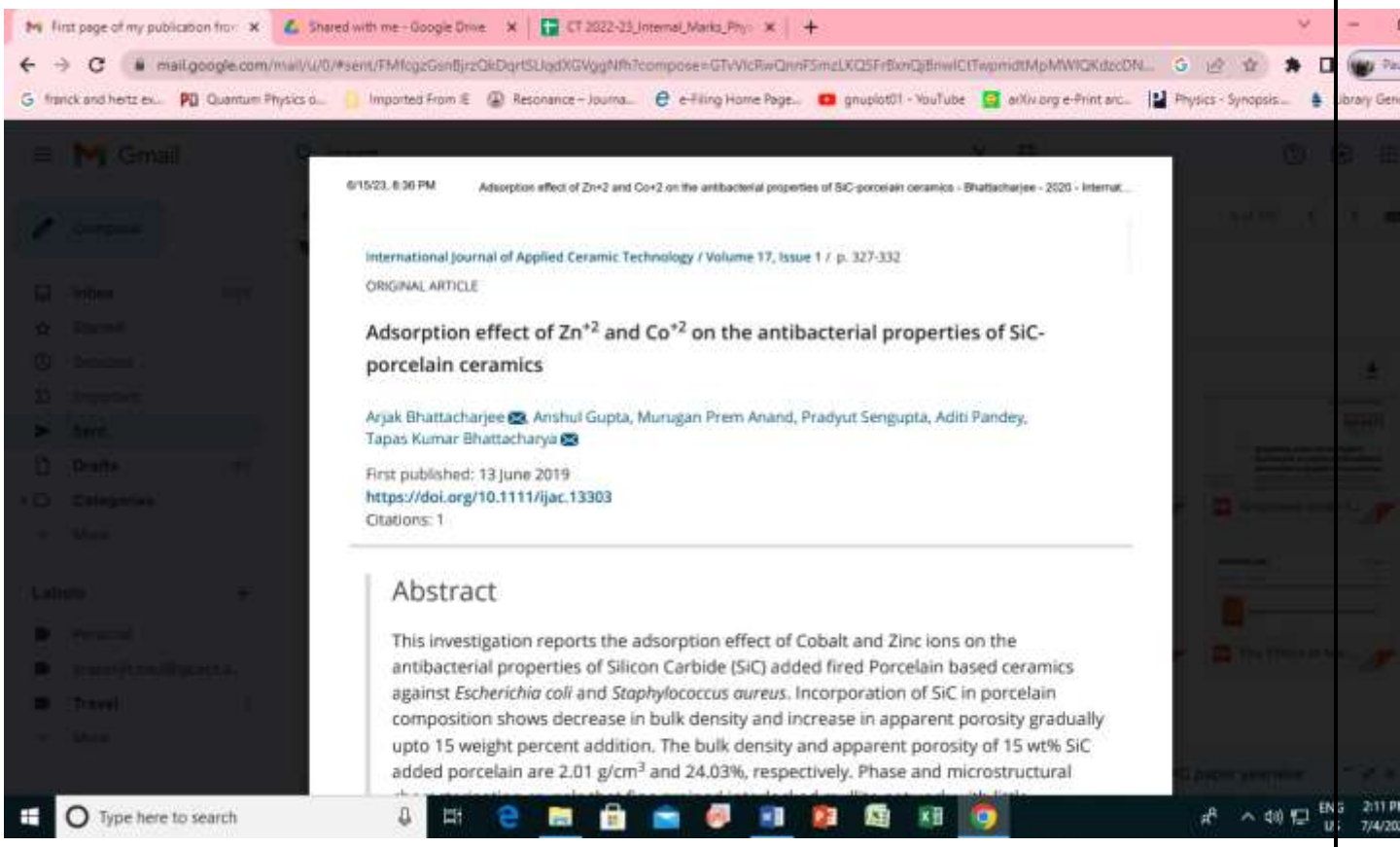

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ORIGINAL ARTICLE

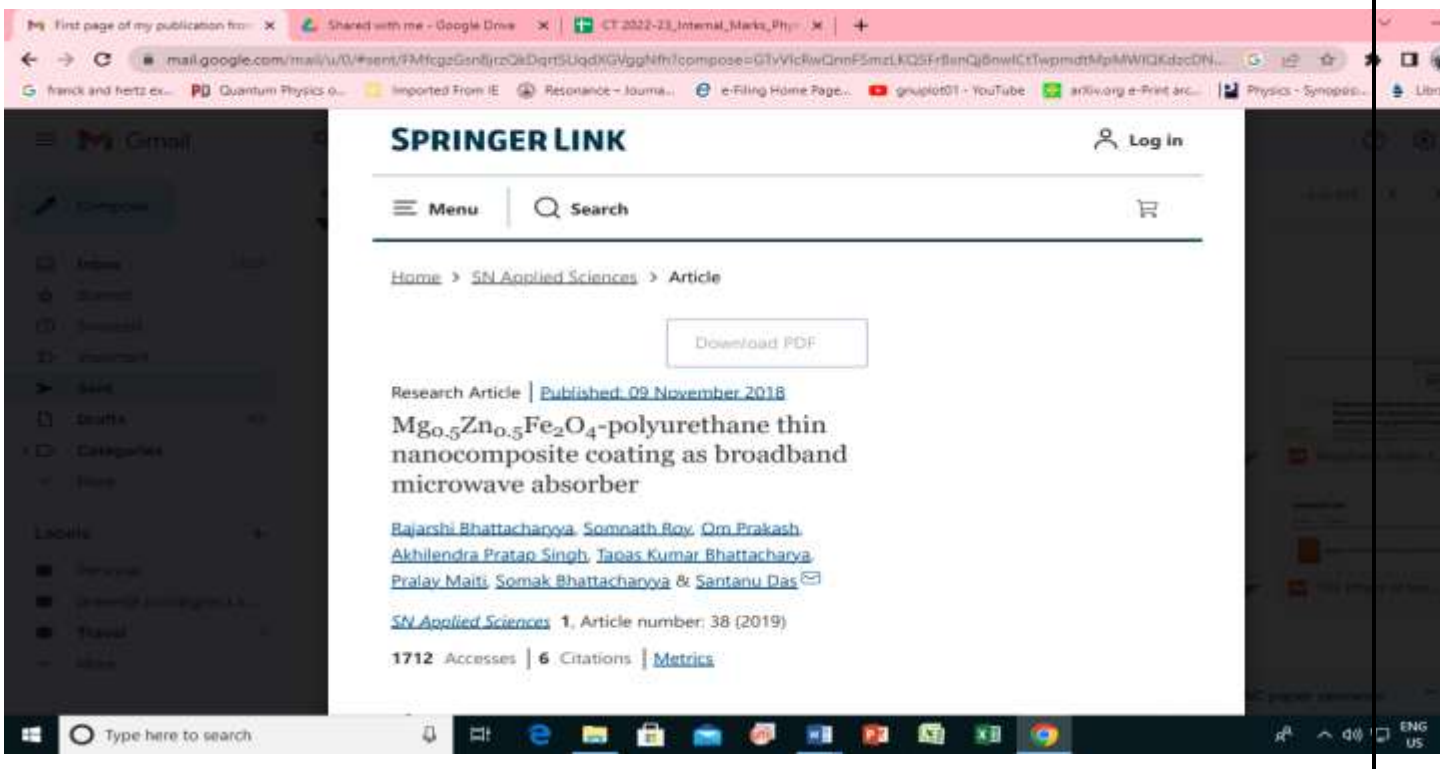
Adsorption effect of Zn^{+2} and Co^{+2} on the antibacterial properties of SiC-porcelain ceramics

Arjak Bhattacharjee, Anshul Gupta, Murugan Prem Anand, Pradyut Sengupta, Aditi Pandey, Tapas Kumar Bhattacharya

First published: 13 June 2019
https://doi.org/10.1111/ijac.13303
Citations: 1

Abstract

This investigation reports the adsorption effect of Cobalt and Zinc ions on the antibacterial properties of Silicon Carbide (SiC) added fired Porcelain based ceramics against *Escherichia coli* and *Staphylococcus aureus*. Incorporation of SiC in porcelain composition shows decrease in bulk density and increase in apparent porosity gradually upto 15 weight percent addition. The bulk density and apparent porosity of 15 wt% SiC added porcelain are 2.01 g/cm^3 and 24.03%, respectively. Phase and microstructural



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$Mg_{0.5}Zn_{0.5}Fe_2O_4$-polyurethane thin nanocomposite coating as broadband microwave absorber

Rajarshi Bhattacharyya, Somnath Roy, Om Prakash, Akhilendra Pratap Singh, Tapas Kumar Bhattacharya, Pralay Maiti, Somak Bhattacharyya & Santanu Das

SN Applied Sciences 1, Article number: 38 (2019)

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Graphene oxide-ferrite hybrid framework as enhanced broadband absorption in gigahertz frequencies

Received: 31 October 2018
Accepted: 24 June 2019
Published online: 20 August 2019

Rajarshi Bhattacharyya[1,2], Om Prakash[2], Somnath Roy[3], Akhilendra Pratap Singh[4], Tapas Kumar Bhattacharya[5], Pralay Maiti[2], Somak Bhattacharyya[4] & Santanu Das[1]

The present investigation is focused on the *in-situ* synthesis of Graphene oxide (GO)-ferrite nanoparticle hybrid framework by gel-combustion method followed by fabrication of homogeneous, structurally stable thin (~100–120 μm) hybrid-polyurethane coating on a metallic aluminum substrate and its application on the properties of broadband absorption over the microwave frequency region. Microstructure studies of hybrid materials illustrated that small sized ferrite nanoparticles (~17 nm) are grafted on and through the graphene layers, which forms a homogeneous coating thereby. The hybrid-nanocomposite coating demonstrated superior broadband absorption properties with absorptivity higher than 90% throughout a bandwidth of ~6 GHz, and moreover, it was found that with increased loading of GO in the nanocomposite, the bandwidth range of absorption frequency increases with enhanced absorptivity. The real part and imaginary part of the surface impedance values of the coating was obtained as 377 Ω and 0 Ω, respectively, which imply that the free-space impedance of the hybrid-nanocomposite coating is matching correctly. The nanocomposite coating showed ultra-high absorptivity over the frequency band of 8–12 GHz, which has numerous practical applications as radar absorbing materials (RAM), stealth technology, electromagnetic shielding, and radiated electromagnetic interference (EMI) management in onboard spacecraft and many more.

The rapid advances in computer technology, communication devices, and wireless electronics and their widespread implementation with increased levels of electromagnetic pollution have led to the quest for developing novel electromagnetic interference (EMI) shielding materials[1–3]. Traditionally metals and metal-based compos-

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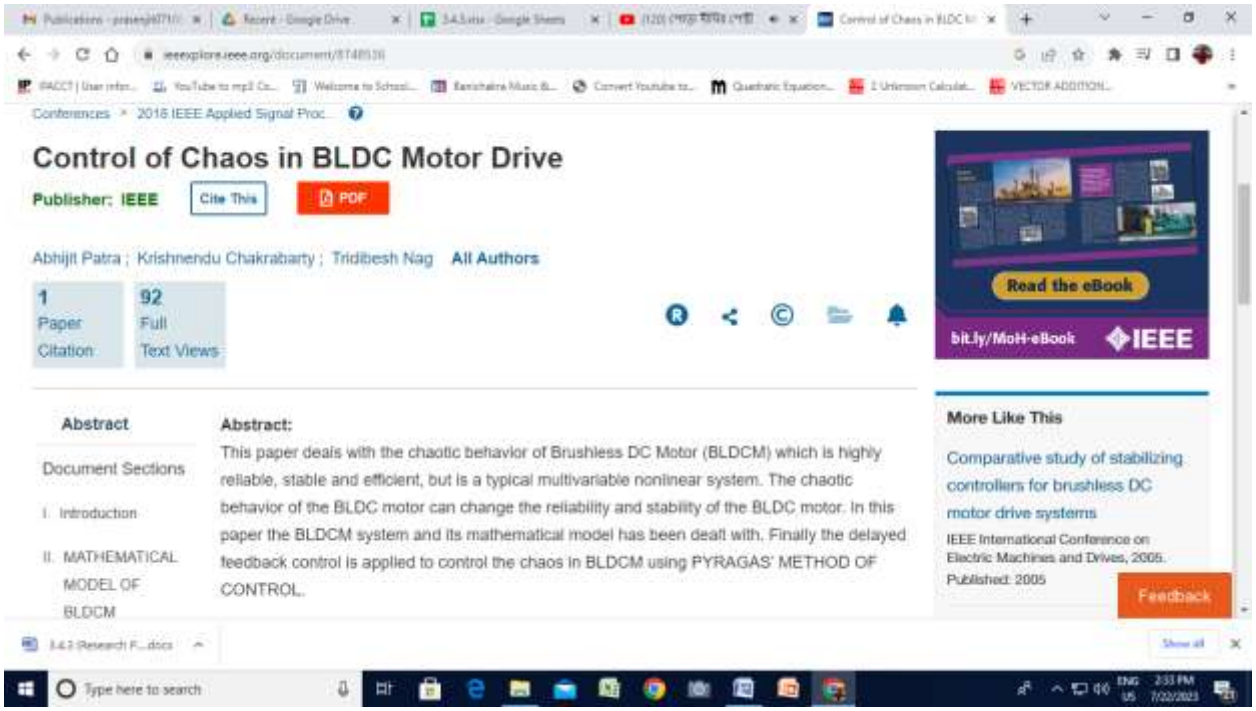
Biological Applications of Schiff base Metal Complexes-A Review

Debdulal Maity
Assistant Professor of Chemistry, Govt. College of Engineering and Ceramic Technology, 73, A. C. Banerjee Lane, Beliaghata. Kolkata-700010, West Bengal, India

Received: January 27, 2019 Accepted: March 10, 2019

ABSTRACT: *Schiff bases synthesized from the condensation of an amino compound with carbonyl compounds and their complexes exhibit a wide range of biological activities including antifungal, antibacterial, antiviral, antitumor and anticancer properties. Over the recent few years, these complexes have gained much attention because of their unique biological properties. Many reports are published on their applications in biological activities of these compounds. Development of a new chemotherapeutic Schiff bases and their metal complexes is now attracting the attention of medicinal chemists. This review is nothing but a small attempt to show different examples of the most promising applied Schiff bases complexes in biological areas.*

Key Words: *Schiff base, Antifungal and antibacterial properties, Antiviral Activities, Anti-cancer agents.*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II. MATHEMATICAL MODEL OF BLDCM
Abstract:
This paper deals with the chaotic behavior of Brushless DC Motor (BLDCM) which is highly reliable, stable and efficient, but is a typical multivariable nonlinear system. The chaotic behavior of the BLDC motor can change the reliability and stability of the BLDC motor. In this paper the BLDCM system and its mathematical model has been dealt with. Finally the delayed feedback control is applied to control the chaos in BLDCM using PYRAGAS' METHOD OF CONTROL.
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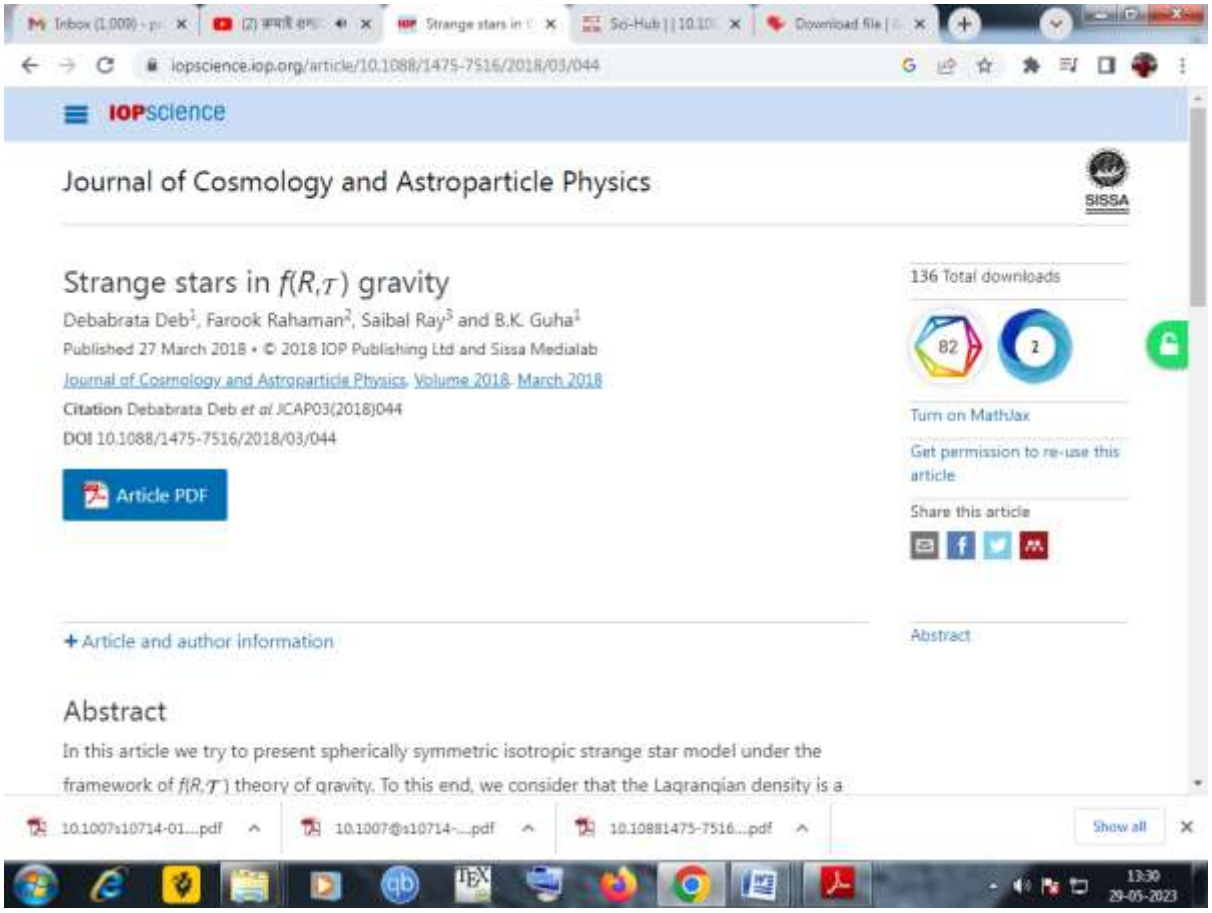

Journal of Cosmology and Astroparticle Physics

Strange stars in $f(R,T)$ gravity

Debabrata Deb[1], Farook Rahaman[2], Saibal Ray[3] and B.K. Guha[1]

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Journal of Cosmology and Astroparticle Physics, Volume 2018, March 2018

Citation Debabrata Deb *et al* JCAP03(2018)044

DOI 10.1088/1475-7516/2018/03/044

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Abstract

Abstract

In this article we try to present spherically symmetric isotropic strange star model under the framework of $f(R,T)$ theory of gravity. To this end, we consider that the Lagrangian density is a


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Anisotropic strange stars in the Einstein–Maxwell spacetime
Debabrata Deb, Maxim Khlopov, Farook Rahaman, Saibal Ray & B. K. Guha
The European Physical Journal C 78, Article number: 465 (2018) | Cite this article
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Abstract
We present here a detailed analysis on the effects of charge on the anisotropic strange star candidates by considering a spherically symmetric interior spacetime metric. To obtain exact solution of the Einstein–Maxwell field equations we have considered the anisotropic
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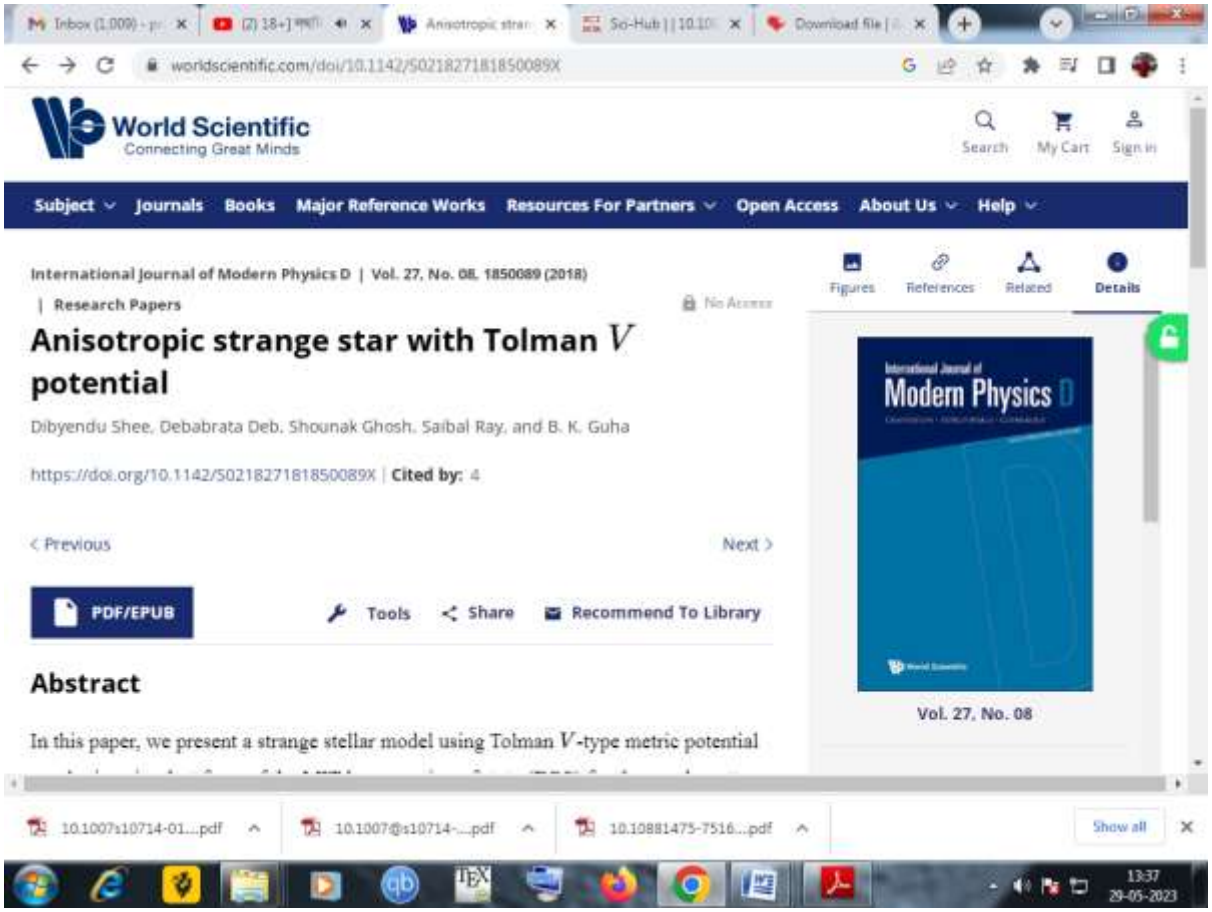
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Abstract
In this paper, we present a strange stellar model using Tolman V-type metric potential
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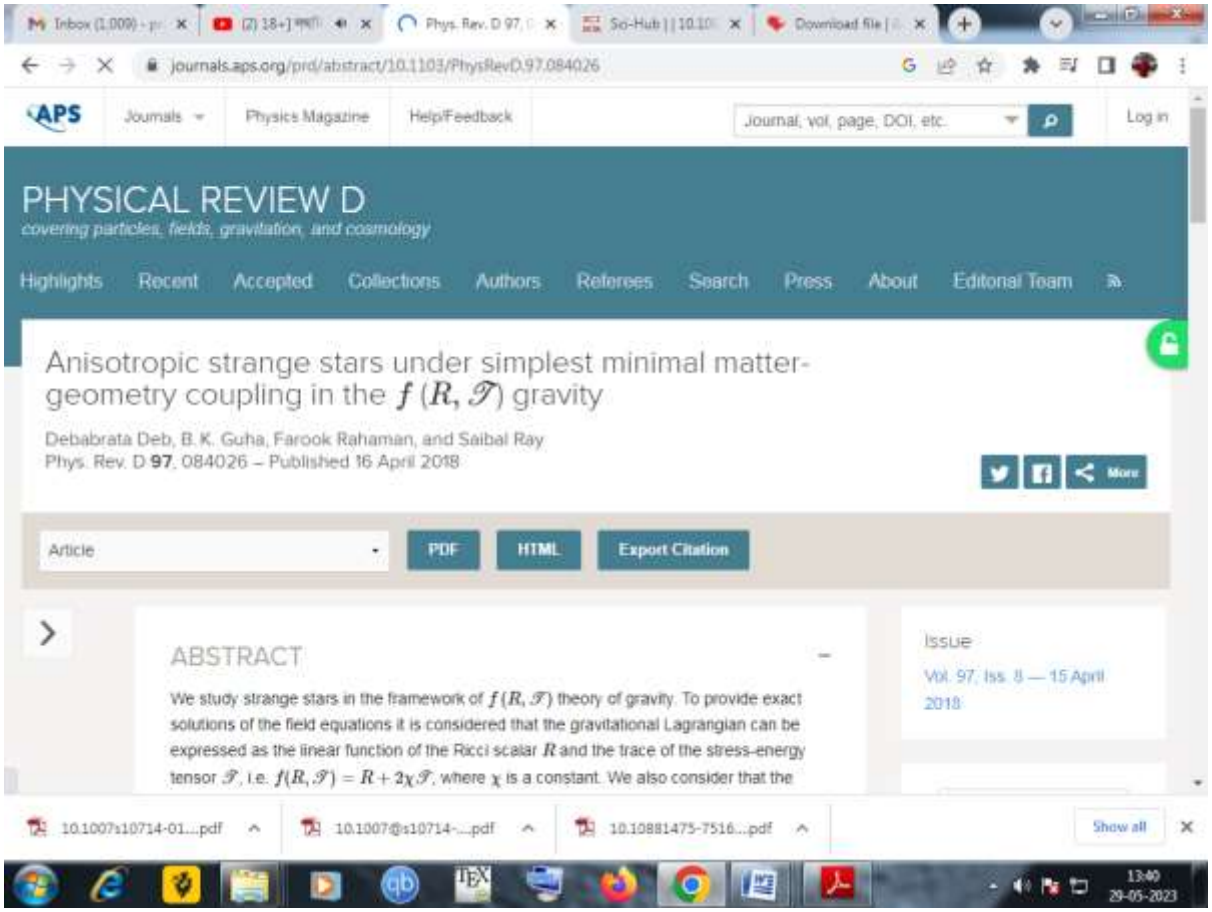
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Anisotropic strange stars under simplest minimal matter-geometry coupling in the $f(R, \mathscr{T})$ gravity
Debabrata Deb, B. K. Guha, Farook Rahaman, and Saibal Ray
Phys. Rev. D 97, 084026 – Published 16 April 2018
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ABSTRACT
We study strange stars in the framework of $f(R, \mathscr{T})$ theory of gravity. To provide exact solutions of the field equations it is considered that the gravitational Lagrangian can be expressed as the linear function of the Ricci scalar R and the trace of the stress-energy tensor $\mathscr{T}$, i.e. $f(R, \mathscr{T}) = R + 2\chi\mathscr{T}$, where χ is a constant. We also consider that the
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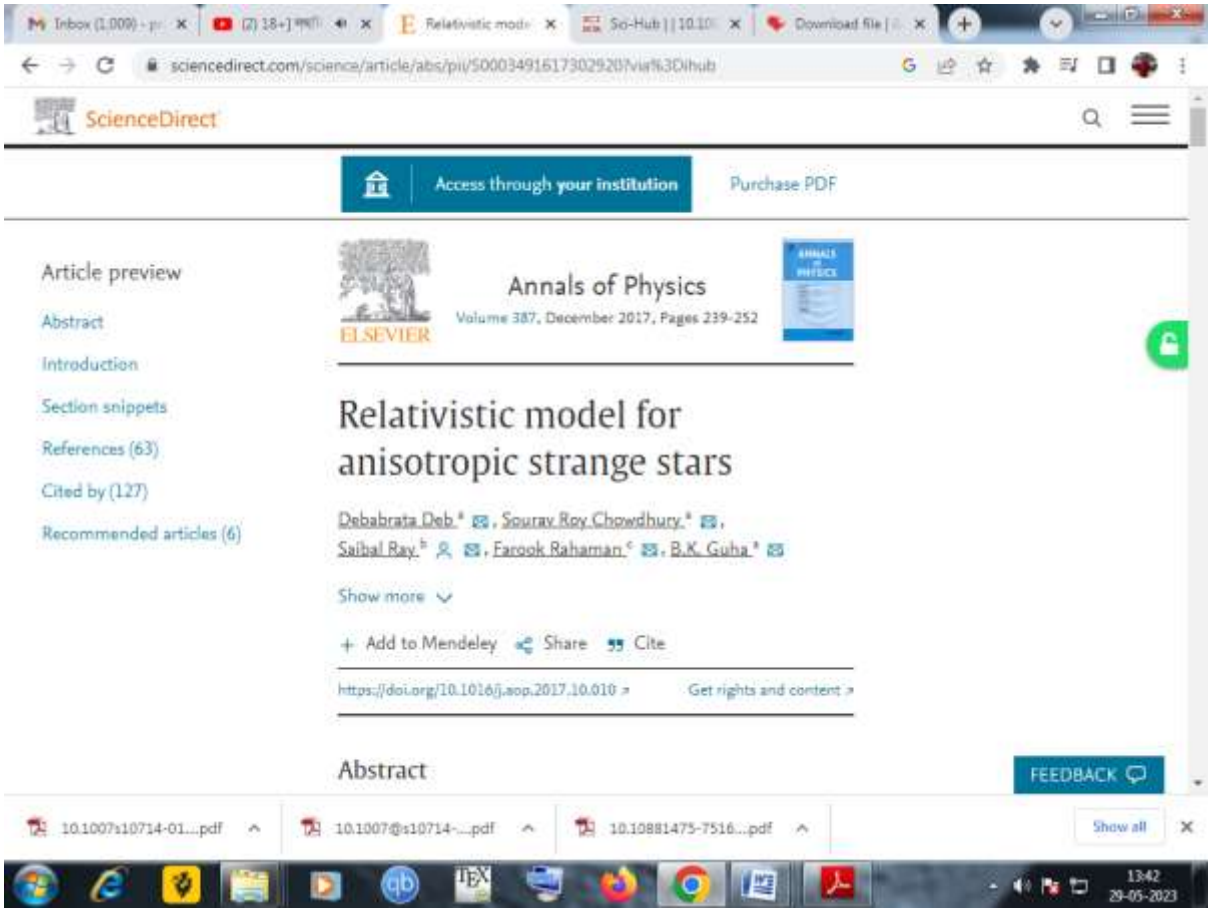
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Digital Signature Protocol for Visual Authentication

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Abstract: *Information security in digital domain is all about assurance of Confidentiality, Integrity, Availability (CIA) extending authenticity and non-repudiation issues. Major concerns towards implementation of information security are computational overhead, implementation complexity and robustness of the protocol. In this paper, we proposed a solution to achieve the target in line with state of the art information security protocol. The computational overhead is significantly reduced without compromising the uncertainty in key pair generation like existing digital signature schemes. The first section deals with collection of digitized signature from an authentic user, generation of shares from the signature, conversion of a cover image to quantized frequency form and casting of a share in appropriate coefficients. In the second section, share detection is done effectively and the data security is confirmed by overlapping the detected share with the other share. Specific constraints are fitted appropriately to recreate a clean digitized signature, reform the cover image using Discrete Cosine Transform (DCT) and quantization method, select frequency coefficients for share casting and manipulate the casting intensity. Impressive effort is made to ensure resistance to some of the common image processing attacks. The undesired white noise is reduced considerably by choosing a suitable threshold value. The selection of pseudorandom hiding position also helps to increase the robustness and the experimental results supports the efficacy of the algorithm.*

Keywords: *Share, DCT and IDCT, image compression, data hiding, SSIM, collusion attack.*

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1. Introduction

The technological escalation and elaborate use of the network domain has extended the use of the Internet. But this advancement has proportionally increased the importance to shield confidential or copyright information through efficient techniques. The most common method of information confidentiality is to encrypt and then imperceptibly hide the sensitive data to restrain intruders.

Some of the existing data hiding techniques explained fabrication of authentication signals into a digital file for assuring the integrity or fidelity of the file [15, 19, 24]. The application of copyright protection also depicts content ownership claim where a digital file is used to embed a visible or invisible digital watermark [2]. In case of covert communication [11, 14] secret information is hidden into a cover file and the intended receiver only can extract the hidden information to complete the communication.

The generation of shares from an information and subsequent sharing of the shares was first explained by Shamir [20]. The challenge is in recovering the information appropriately when the related shares are combined. Conventionally, the two concepts viz. data hiding and information sharing can both be an integral part of information security.

Nowadays researchers are concentrating more on encryption and masking based image authentication techniques [7, 12] along with exploiting the redundant information of an image to fabricate the secret information. In context to the authentication method, the existing algorithms can be broadly classified as spatial and transform domain techniques. In the spatial domain techniques, high volume of payload can be fabricated with minimum computational complexity but less resistance to low pass filtering and common image processing attacks. Hence widely accepted algorithms are mostly in transform domains i.e., Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT) and Discrete Wavelet Transform (DWT) etc., [16, 21, 22]. Prior to these transform techniques, the concept of Spread Spectrum based watermarking techniques also exploited Human Visual Systems (HVS) [5, 9, 18].

Cox *et al*. [5] suggested DCT domain to be an extensively used transform in Joint Photographic Experts Group (JPEG) compression. In DCT domain the possibility of coefficients getting affected by compression are known at prior and as a protective measure use of middle-band frequency coefficients to embed the secret data was first proposed by Koch and Zhao [9].

As per the study of the existing research, some spatial and transform domain techniques are chronologically mentioned. Bender *et al*. [3] suggested

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Hybrid Parallel Programming Using Locks and STM

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Abstract— Software Transactional Memory (STM) is a new alternative approach to locks which solves the problem of synchronization in parallel programs. In STM users have to identify the critical sections in the program and enclose them within transactions by using appropriate STM function calls. Then STM automatically by its internal constructs ensures synchronization in the program. This paper shows how to solve the problem of synchronization in parallel programs by using a hybrid programming approach using both locks and STM. Locks use pessimistic approach to solve the problem of synchronization in parallel programs. STM uses optimistic approach to solve the problem of synchronization in parallel programs. Both the optimistic and pessimistic approaches have some advantages and disadvantages. The disadvantage of optimistic approach is that transactions are aborted when validation cannot be done. This approach works well when there are no conflicts (hence the term optimistic) but wastes work when there are conflicts. Aborting of transactions is a severe problem when the transactions are long and interactive. The disadvantage of pessimistic approach is that large number of locks in the program will lead to very slow execution speed which may cancel out the gains made by solving the problem in parallel. The hybrid approach combines the advantages of the optimistic and pessimistic approaches removing their disadvantages without any degradation of performance.

Keywords— Multiprocessing, Parallel Processing, Locks, Software Transactional Memory, Hybrid Parallel Programming

I. INTRODUCTION

Ensuring synchronization is a very important problem in parallel programs. Currently locks are used to solve this problem. Locks use pessimistic approach. Software transactional memory (STM) is a promising alternative approach for parallel computation which does not have most of the limitations of the locks-based approach. STM uses optimistic approach. Both the optimistic and pessimistic approaches have some disadvantages.

In the pessimistic approach it is always assumed that results will surely be erroneous if multiple threads execute the critical section simultaneously which may not always be the case. The more the number of critical sections in a program the more will be the number of locks. Large number of locks in the program will lead to very slow execution speed which may cancel out the gains made by solving the problem in parallel **[1]**.

The main disadvantage of the optimistic approach is that in those types of problems where simultaneous execution of critical sections by multiple threads leads to inconsistency the same critical sections have to be executed again and again until the values are consistent. This may lead to drastic degradation of performance and may overset all the gains achieved by parallel execution **[2]**.

In this paper we present a hybrid approach using both locks and STM to solve the problem of synchronization in parallel programs. The programming example considered is finding out the minimum element in an array. It is a small prototype of a real-life example in which different areas of a database are accessed in real time in parallel.

In the example which we have used the simultaneous execution of multiple critical sections by multiple threads will lead to inconsistency. Thus in this case the use of pessimistic approach is more advantageous. When the optimistic approach (STM) was used the transactions were aborted a large number of times as simultaneous execution of multiple critical sections by multiple threads was frequently leading to inconsistency. Thus the same critical sections were executed again and again. This resulted in large execution time (24 sec). The disadvantage of optimistic approach is that transactions are aborted when validation cannot be done. This approach works well when there are no conflicts (hence the term optimistic) but wastes work when there are conflicts. Aborting of transactions is a severe problem when the transactions are long and interactive **[3]**. When the pessimistic approach (locks) was used the execution time was 5 seconds. In the hybrid approach the pessimistic approach was used in one half of the array and optimistic approach in the other half. The execution time was 5 seconds. Thus we can say that the hybrid approach combines the advantages of the optimistic and pessimistic approaches removing their disadvantages without any degradation of performance.

In the ideal case hybrid approach may also lead to

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FAULT-TOLERANT STM (SOFTWARE TRANSACTIONAL MEMORY) USING REPLICATION

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ABSTRACT

Software Transactional Memory (STM) ensures synchronization in parallel programs without suffering from the drawbacks of locks. Fault tolerance is an important issue in STM. In this paper we ensure fault tolerance in STM by using replication. Whenever any transaction suddenly aborts another transaction starts which performs the same operations as the transaction which has aborted. Thus even if any transaction fails or is aborted due to some reason then the result is not affected. We have also seen that there is no performance degradation if this approach is used. We have replicated only the important transactions so that redundancy is kept to the bare minimum. Thus we can say that we have developed an approach using replication which has made STM fault-tolerant without any performance degradation keeping redundancy to the bare minimum.

Keywords: Multiprocessing, Parallel Processing, Locks, Software Transactional Memory, Fault Tolerance.

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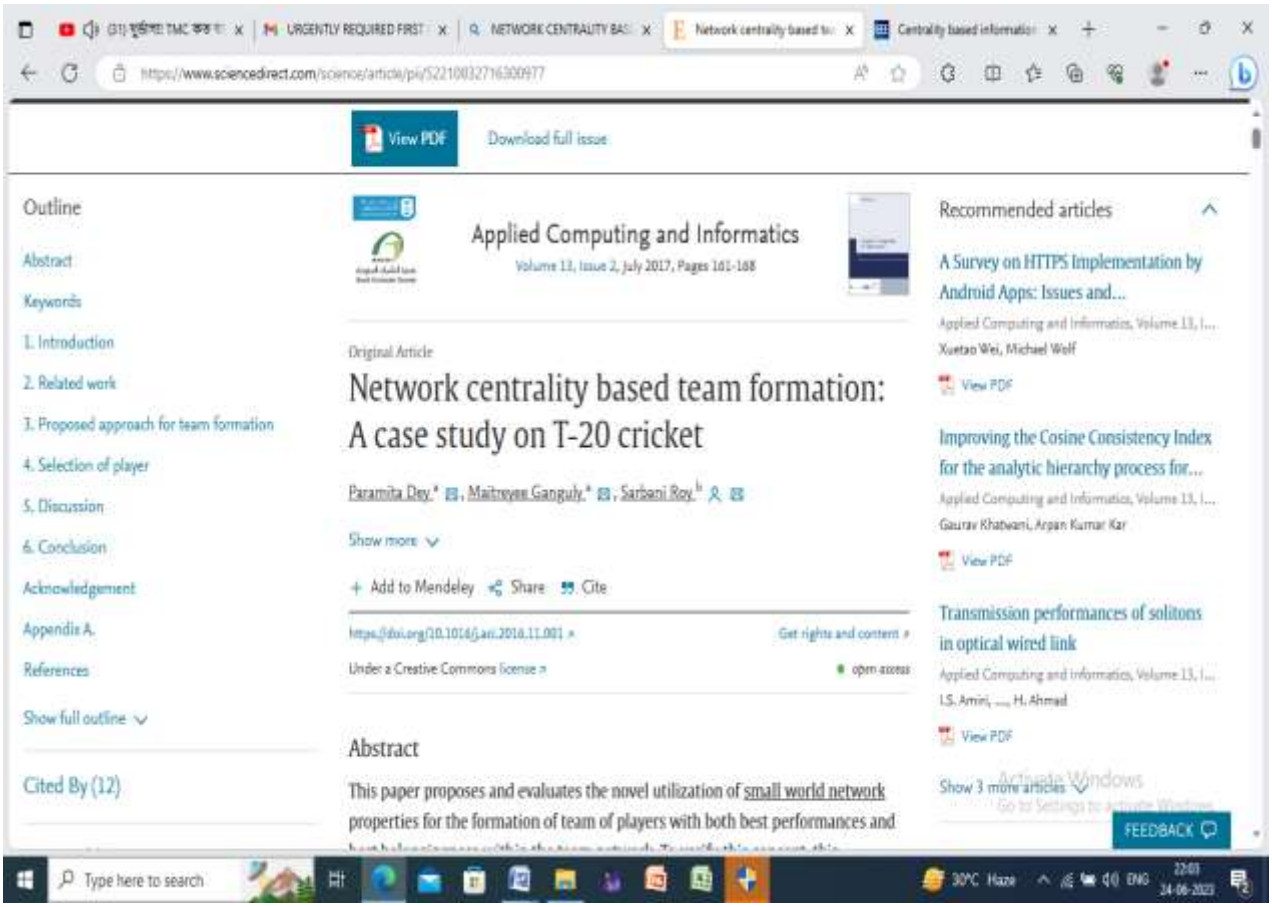
1. INTRODUCTION

Ensuring synchronization is a very important problem in parallel programs. Currently locks are used to solve this problem. Software transactional memory (STM) is a promising alternative approach for parallel computation which does not have most of the limitations of the locks-based approach. [1] However fault-tolerance is a very important issue in STM.

Fault-tolerance is the capability of a computer system, electronic system or network to deliver uninterrupted service, despite one or more of its components failing. Fault tolerance also resolves potential service interruptions related to software or logic errors. The purpose is to prevent catastrophic failure that could result from a single point of failure. In STM if any transaction fails or is aborted for some reason then the result is incorrect. Thus we can say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