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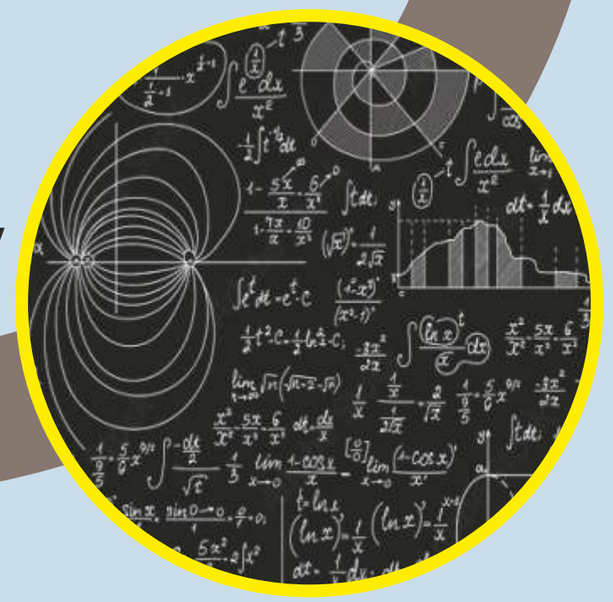

3-7 January, 2023
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SECTION OF MATHEMATICAL SCIENCES (INCLUDING STATISTICS)

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PART II
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(INCLUDING STATISTICS)

President: Prof. Shishir Gupta

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108th INDIAN SCIENCE CONGRESS

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PRESIDENTIAL ADDRESS

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TORSIONAL SURFACE WAVE IN ANISOTROPIC MEDIA

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Abstract

In the present paper we study the effect of rigid boundary on the torsional wave propagation in an anisotropic porous half-space under the effect of gravitation. The equation of motion has been formulated for finding displacement components of the proposed half-space. Using appropriate boundary conditions, dispersion relation containing Whittaker's function for phase velocity due to torsional surface waves has been derived. Some particular cases have been derived from the dispersion relation in absence of anisotropy, gravitation, and porosity of the medium. The effect of porosity, anisotropy and gravity parameters on the propagation of torsional waves has been exhibited by means of graphs. The study may be useful to understand the nature of propagation of seismic waves during earthquake.

1. Introduction

In today's era, the study of surface wave propagation became the most frequently researched topic in earthquake engineering to both seismologists and physicists because of their devastating damage capabilities during earthquakes. The nature of different surface seismic wave is studied in theoretical seismology and also has some practical importance in the field of Civil Engineering, Rock Mechanics and Geophysical Prospecting. The well-known book by Ewing et al. contains a significant amount of knowledge about the propagation of seismic waves [1]. In fact, theoretical seismologists have a keen interest in the study of surface waves for homogeneous, non-homogeneous, and isotropic and anisotropic layered media. Of those, the commendable works by Vrettos

[2, 3] on surface waves in inhomogeneous medium may be cited. His studies give much information on the effects of non-homogeneity on surface waves caused by line loads.

Among different surface type waves such as Love wave, Rayleigh wave or Stonely wave, the torsional surface wave has not drawn much attention and only scanty literature is available on the propagation of such waves. Lord Rayleigh [4], in his remarkable paper, showed that the isotropic homogeneous elastic half space does not allow a torsional surface wave to propagate. Later on, Meissner [5] pointed out that in an inhomogeneous elastic half space with quadratic variation of shear modulus and density varying linearly with depth, torsional surface waves do exist. Recently, Vardoulakis [6] has shown that torsional surface waves also propagate in Gibson half space, that is, a half space in which the shear modulus varies linearly with depth but where the density remains unchanged. Georgiadis et al. [7] have shown that torsional surface waves do exist in gradient elastic half space. Torsional surface waves in an initially stressed cylinder have been studied by Dey and Dutta [8], and the existence and propagation of torsional surface waves in an elastic half space with void pores has been discussed by Dey et al. [9]. The propagation of torsional surface waves in a visco-elastic medium has been discussed by Dey et al. [10]. The propagation of torsional surface waves in a homogeneous substratum over a heterogeneous half space has been studied by Dey et al.[11]. The propagation of torsional surface waves in non-homogeneous and anisotropic medium with polynomial and exponential variation in rigidity and constant density has been discussed by Dey et al. [12]. Whether torsional surface waves can propagate in the presence of a gravity field if the medium is elastic or dry sandy has been studied by Dey et al. [13]. Torsional surface waves will always propagate if the medium is taken as sandy or elastic in gravitating earth under initial stress [14]. The presence of initial stress effects on the propagation of torsional surface waves in a non-homogeneous anisotropic medium has been studied by Dey et al. [15].

The study of propagation of surface waves in anisotropic medium with porous layer is very much useful in many engineering fields. The anisotropic porous layer can be found naturally beneath the surface of the Earth. In general, the pores contain hydrocarbon deposition such as gas and oil. Most oil and gas deposits are found in sandstone or limestone is very much like a hard sponge, full of holes but not compressible. These holes or pores can contain water or oil or gas and rock will be saturated with one of these three. The holes are much tinier than sponge holes but they are still holes and they are called porosity and the layer is called porous layer. In the area of geophysical issues pertaining to the exploitation of oil and underground water, studies of

torsional wave propagation in a liquid saturated porous material play a significant role.There are a number of theories describing the mechanical properties of porous materials. The most well-known one of them is the Biot consolidation theory of fluid-saturated porous solids [16],[17],[20]. Later, few author's investigated some articles related to torsional wave in porous medium such as Dey and Sarkar [21] deduced torsional surface waves in an initially stressed anisotropic porous medium. Gupta and Gutpa [22] shown torsional surface waves in gravitating anisotropic porous half space.

Inside the Earth, a very hard layer, also known as rigid, is present. Since the composition of the Earth is heterogeneous, including very hard layers, medium heterogeneity and rigid surfaces play a significant role in the propagation of seismic waves. The effect of a rigid boundary on the propagation of a torsional wave in a layered structure has been proposed by Gupta et al. [23]-[25].Dey et al.[26] has studied propagation of torsional surface waves in an elastic layer with void pores over an elastic half-space with void pores.The present article attempts to study the propagation of torsional surface waves in a gravitating anisotropic poro-elastic half space. The half-space is considered with rigid boundary. Keeping this in view, an attempt has been made to find out whether such a half space can allow propagating the torsional surface wave or not. It is noticed that the torsional surface waves can exist in anisotropic porous medium with rigid boundary in presence or absence of gravity field.

2. Mathematical Formulation of the problem

Consider a gravitating anisotropic porous half-space with rigid boundary. To study torsional surface wave a cylindrical co-ordinate system is introduced, with the z-axis towards the interior of the anisotropic porous half-space. The half-space is under the action of the gravity field. The origin of cylindrical co-ordinate system has been taken at the interface of the rigid boundary and z-axis downward positive (see Fig. 1). Let r and (be the radial and circumferential co-ordinates respectively. It is assumed that torsional wave travels in the radial direction and that all mechanical properties associated with it are independent of (. For torsional wave $u = w = 0$ and $v = v(r,z,t)$ and the equation of motion in anisotropic porous medium under gravity may be written as Biot[16]

$$\frac{\partial \sigma_{r\theta}}{\partial r}+\frac{\partial \sigma_{z\theta}}{\partial z}+\frac{2\sigma_{r\theta}}{r}-\frac{\partial}{\partial z}\left(d'gze_{z\theta}\right)-d'g\frac{\partial}{\partial r}\left[\frac{1}{2}\left(\frac{\partial v}{\partial r}+\frac{v}{r}\right)\right]=\frac{d'\left(\partial^2 v\right)}{\partial t^2} \tag{1}$$

where $v(r,z,t)$ is displacement along ϑ direction. g is acceleration due to gravity.

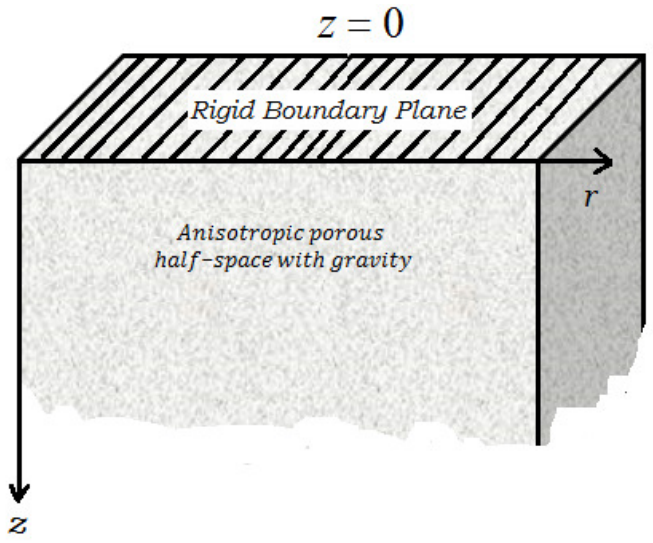

Fig 1: Geometry of the problem

For gravitating anisotropic porous medium the stress is related to strain by

$$\sigma_{r\theta}=2Ne_{r\theta},\sigma_{z\theta}=2Le_{z\theta},e_{r\theta}=\frac{1}{2}\left(\frac{\partial v}{\partial r}-\frac{v}{r}\right),e_{z\theta}=\frac{1}{2}\frac{\partial v}{\partial z} \tag{2}$$

where N and L be the shear modulus of elasticity along r and z direction respectively.

Using the above relation (2), eq. (1) takes

$$\left(N-\frac{1}{2}d'gz\right)\left(\frac{\partial^2 v}{\partial r^2}-\frac{v}{r^2}+\frac{1}{r}\frac{\partial v}{\partial r}\right)+\left(L-\frac{1}{2}d'gz\right)\frac{\partial^2 v}{\partial z^2}-\frac{d'g}{2}\frac{\partial v}{\partial z}=d'\frac{\partial^2 v}{\partial t^2} \tag{3}$$

where $d' = \rho_{rr} - \frac{\rho_{r\theta}^2}{\rho_{\theta\theta}}$ and $\rho_{rr}, \rho_{r\theta}, \rho_{\theta\theta}$ are mass coefficients and these are related to the densities ρ, ρ_s, ρ_w of the layer, the solid and the water respectively by

$$\rho_{rr} + \rho_{r\theta} = (1-f)\rho_s \ , \ \rho_{r\theta} + \rho_{\theta\theta} = f\rho_w \tag{4}$$

where f is the porosity of the layer, so that the mass densities of the bulk material are

$$\begin{aligned}\rho' &= \rho_{rr} + 2\rho_{r\theta} + \rho_{\theta\theta} \\ &= (\rho_{rr} + \rho_{r\theta}) + (\rho_{r\theta} + \rho_{\theta\theta}) \\ &= \rho_s + f(\rho_w - \rho_s)\end{aligned} \tag{5}$$

The above relation shows that in case of fluid of lighter density (ρ_w) is filled up in the solid matrix of density (ρ_s) then the density of aggregate (ρ') will be less than the density of the solid (ρ_s), there may be the case of heavier fluid such as mercury, molten metal etc. filled in the solid matrix, when the density of the aggregate will be more than that of solid. Further this relation shows that as porosity factor f decreases from 1 to 0 i.e. as the volume of pores decreases, the density of aggregate tends to the density of solid. It has been shown by Biot [17] that the mass coefficients obey the following inequality also:

$$\rho_{rr} \geq 0, \qquad \rho_{\theta\theta} \geq 0, \qquad \rho_{r\theta} < 0, \qquad \rho_{rr}\rho_{\theta\theta} - \rho_{r\theta}^2 \geq 0$$

The parameters may be non-dimensionalised as

$$\gamma_{11} = \frac{\rho_{rr}}{\rho'}, \qquad \gamma_{12} = \frac{\rho_{r\theta}}{\rho'}, \quad \gamma_{22} = \frac{\rho_{\theta\theta}}{\rho'}$$

$$d = \frac{d'}{\rho'} = \frac{1}{\rho'}\left(\rho_{rr} - \frac{\rho_{r\theta}^2}{\rho_{\theta\theta}}\right) = \gamma_{11} - \frac{\gamma_{12}^2}{\gamma_{22}}$$

Thus one gets the following:

i) $d \to 1$, when the layer is non-porous solid.

ii) $d \to 0$, when the layer is fluid.

iii) $0 < d < 1$, when the layer is poro-elastic.

For the wave propagating along r direction one may assume the solution of equation (3) as

$$v = V(z)J_1(Kr)e^{i\omega t} \tag{6}$$

Here V is the solution of

$$V'' - \frac{GKd}{2\left(1-\frac{GdKz}{2}\right)}V' - K^2\left[\frac{N\left(1-\frac{GdKzL}{2N}\right)}{L\left(1-\frac{GdKz}{2}\right)} - \frac{C^2d}{C_1^2\left(1-\frac{GdKz}{2}\right)}\right]V = 0 \tag{7}$$

where $C = \frac{\omega}{K}$ is the velocity of torsional wave $C_1 = \left(\frac{L}{\rho'}\right)^{\frac{1}{2}}$ is the velocity of shear wave in anisotropic elastic medium along r direction. $G = \frac{g\rho'}{LK}$ is Biot's Gravity parameter, K is wave number and J_1 the Bessel function of the first kind of order one.

Substituting $V = \frac{\phi(z)}{\left(1-\frac{GdKz}{2}\right)^{\frac{1}{2}}}$ in equation (7), we obtain

$$\phi''(z) + \left[\frac{G^2K^2d^2}{\left(1-\frac{GdKz}{2}\right)^2} - K^2\left[\frac{N\left(1-\frac{GdKzL}{2N}\right)}{L\left(1-\frac{GdKz}{2}\right)} - \frac{C^2d}{C_1^2\left(1-\frac{GdKz}{2}\right)}\right]\right]\phi(z) = 0 \tag{8}$$

Again substituting $\delta = \frac{4}{Gd}\left(1-\frac{GdKz}{2}\right)$ in equation (8), it may be reduced to

$$\phi''(\delta) + \left[-\frac{1}{4} + \frac{m}{\delta} + \frac{1}{4\delta^2}\right]\phi(\delta) = 0 \tag{9}$$

where $m = \frac{C^2}{C_1^2G} + \frac{1}{Gd}\left(1-\frac{N}{L}\right)$.

Equation (9) is known as Whittaker's equation [19], whose solution is

$$\phi(\delta) = A_1 W_{m,0}(\delta) + A_2 W_{m,0}(-\delta) \tag{10}$$

As the solution should vanish at $z \to \infty$, i.e. for $\delta \to -\infty$, we may take the solution as

$$\phi(\delta) = A_2 W_{m,0}(-\delta) \tag{11}$$

Hence, the solution of equation (3) may be expressed as

$$v = \frac{A_2 W_{m,0}\left[-\frac{4}{Gd}\left(1 - \frac{GdKz}{2}\right)\right]}{\left(1 - \frac{GdKz}{2}\right)^{\frac{1}{2}}} J_1(Kr) e^{i\omega t} \tag{12}$$

3. Boundary Conditions

The boundary condition for a torsional surface wave propagating in anisotropic gravitating porous medium with rigid boundary is given by

$$v = 0 \text{ at } z = 0 \tag{13}$$

Case-I

Expanding Whittaker function up to linear term (as in the expansion, depth (z) occurs in the denominator of each term with higher powers and surface waves vanishes with increase in depth) and using boundary condition (13), the velocity equation takes the form

$$\frac{C}{C_1} = \left[\left(\frac{2 - Gd}{4}\right)G + \frac{1}{d}\left(\frac{N}{L} - 1\right)\right]^{\frac{1}{2}} \tag{14}$$

Case-II

Expanding Whittaker function up to quadratic term (as in the expansion, depth (z) occurs in the denominator of each term with higher powers and surface waves vanishes with increase in depth) and using boundary condition (13), the velocity equation takes the form

$$\left(\frac{C}{C_1}\right)^4 + X_1\left(\frac{C}{C_1}\right)^2 + X_2 = 0 \tag{15}$$

where

$$X_1 = \frac{G}{4}(4Gd - 8) + \frac{2}{d}\left(1 - \frac{N}{L}\right) \tag{16}$$

$$X_2 = \left[(G^2d^2 - 2Gd + 3) + (4Gd - 8)\left(\frac{1}{Gd}\right)\left(1 - \frac{N}{L}\right) + \frac{4}{G^2d^2}\left(1 - \frac{N}{L}\right)^2\right]\frac{G^2}{4} \tag{17}$$

The equation (14) and equation (15) give the following information:

i) When $G = 0$, equation (14) and equation (15) gives

$$\frac{C}{C_1} = \left[\frac{1}{d}\left(\frac{N}{L} - 1\right)\right]^{\frac{1}{2}}$$

which shows that in the absence of G and with rigid boundary, the wave is still available.

ii) Taking $G = 0$ and $N = L$, in equations (14) and (15), we obtain

$$\frac{C}{C_1} = 0$$

Thus in case of isotropic medium in the absence of G and with rigid boundary the wave does not propagate.

iii) For poro-elastic medium $0 < d < 1$, it is observed that the velocity of wave is more than that of elastic medium (i.e. $d = 1$).

iv) When the medium is a perfect liquid $(d \to 0)$, the velocity of torsional wave tents to zero, because we have $d = \frac{d'}{\rho'}$ and as $d \to 0$, then $\rho' \to \infty$ therefore $C_1 = \sqrt{\frac{L}{\rho'}} \to 0$ the velocity of shear wave in anisotropic medium is zero. New from equation (14), we obtain $C = 0$, since $C_1 = 0$, which shows that torsional surface wave does not exists.

v) When $G \neq 0$ and $N = L$, equation (14) gives

$$\frac{C}{C_1} = \left[\left(\frac{2 - Gd}{4}\right)G\right]^{\frac{1}{2}}$$

and equation (15) gives

$$\frac{C}{C_1} = \left[\left(\frac{2 - Gd}{4}\right)G + \frac{G}{2}\sqrt{1 - 2Gd}\right]^{\frac{1}{2}}$$

which shows that in the presence of gravity field the wave propagates even if the medium is isotropic.

4. Numerical Results and Discussions

Numerical values of $\frac{C}{C_1}$ have been calculated from equation (14) and equation (15) for $0 < d \leq 1$ and $\frac{N}{L} = 1,2,3.$ The results are presented in Figure 2 and Figure 3.

In Figure 2, linear expansion of Whittaker Function is taken whereas in Figure3, quadratic expansion of Whittaker function is taken**.** We have plotted phase velocity C/C1 against G for the following cases:

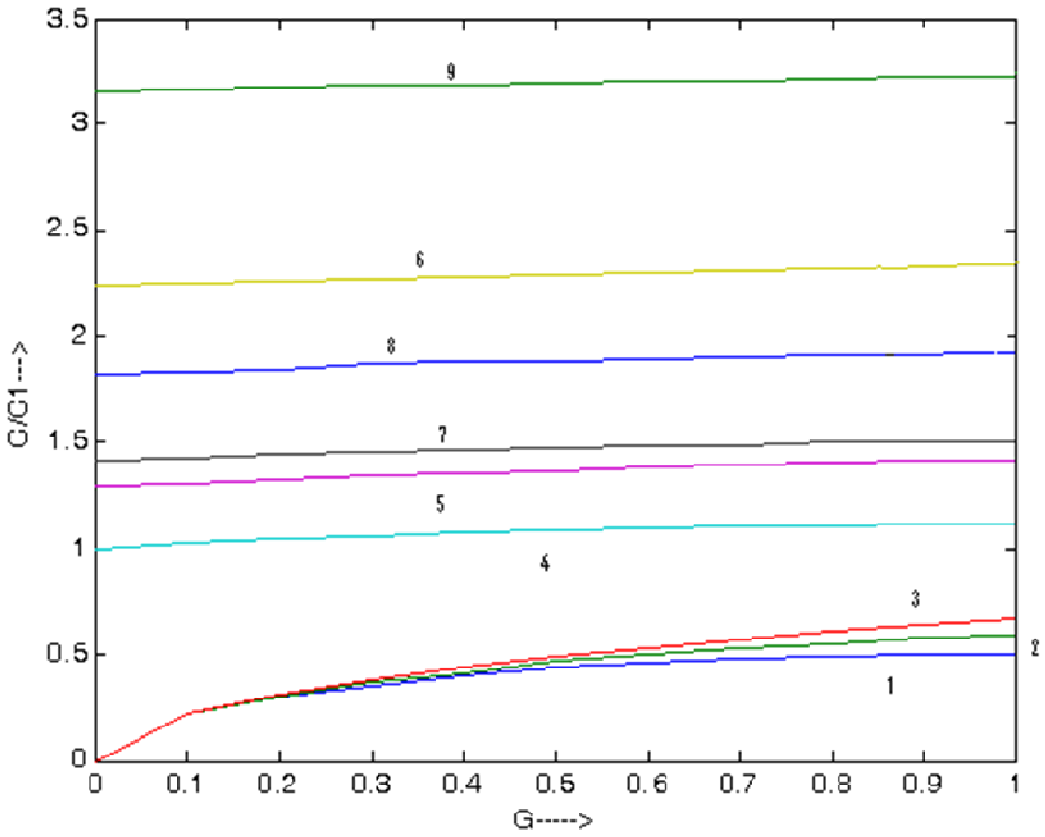

Fig 2: Velocities of torsional surface waves showing the effect of gravity field, porosity and anisotropy in its propagation (taking the expansion of Whittaker function up to linear term.) its propagation (taking the expansion of Whittaker function up to linear term.)

In fig. 2, curve no. 1 is drawn for isotropic and elastic medium (i.e. $N = L$ and $d = 1$). Curve no. 2 and 3 are drawn for isotopic poro-elastic medium (i.e. $N = L$ and $d \neq 1$). Curve no. 4 and 7 represent anisotropic and elastic medium (i.e. $N \neq L$ and $d = 1$). The anisotropic pro-elastic medium (i.e. $N \neq L$ and $d \neq 1$) has been shown in curve no. 5, 6, 8 and 9. G increases as the velocity of torsional wave increases. The velocity is also seen to increase considerably as increases. It may be concluded that the poro-elasticity has dominant effect in the propagation of torsional wave when compared with the presence of gravity field.

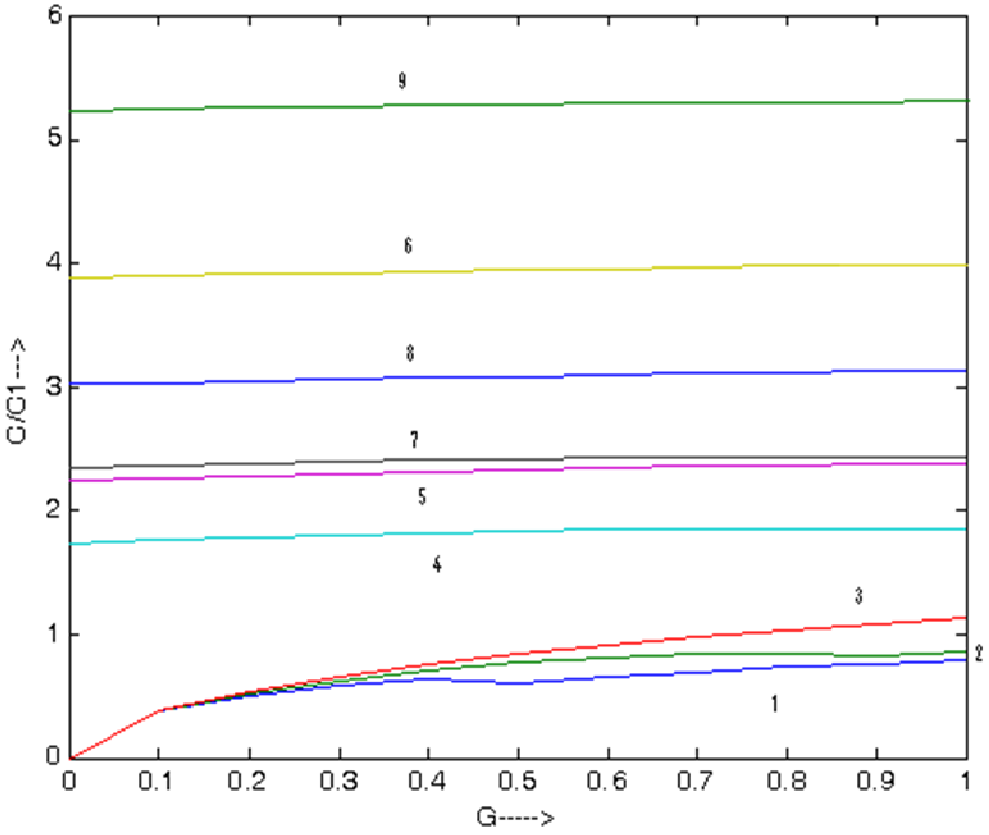

Fig. 3: Velocities of torsional surface waves showing the effect of gravity field, porosity and anisotropy in its propagation (taking the expansion of Whittaker function up to quadratic term.)

In fig. 3, curve no. 1 is drawn for isotropic and elastic medium (i.e. $N = L$ and $d = 1$). Curve no. 2 and 3 drawn for isotropic poro-elastic

medium (i.e. $N = L$ and $d \neq 1$). Curve no. 4 and 7 represent anisotropic and elastic medium (i.e. $N \neq L$ and $d = 1$). The anisotropic poro-elastic medium (i.e. $N \neq L$ and $d \neq 1$) has been shown in curve no. 5, 6, 8 and 9. G increases as the velocity of torsional wave increases. The velocity is also seen to increase considerably as N/L increases. It may be concluded that the poro-elasticity has dominant effect in the propagation of torsional wave when compared with the presence of gravity field.

5. Conclusion

In this article, we have investigated the propagationof torsional surface waves in an anisotropic porous gravitating medium with rigid boundary. By the detailed numerical computation and graphical representation, we concluded the following results:

- It is found that torsional surface waves can exist in anisotropic porous medium with rigid boundary in presence or absence of gravity field.
- The study reveals that anisotropy in the medium has a notable effect on the propagation of torsional surface waves.
- The velocities have been calculated numerically and the effects of anisotropy, gravity and porosity on torsional wave velocity are shown graphically.
- The velocity of the wave increases considerably as the porosity of the medium increases.
- It is also observed that gravity present in the medium has significant effect on torsional wave velocity.
- It is seen that the presence of gravity field increases the velocity of torsional surface wave.
- The torsional wave does not propagate in an elastic homogeneous isotropic medium with rigid boundary in the absence of gravity field.
- Since the earth is gravitating medium, the propagation of torsional surface wave is therefore always possible along with other seismic waves.

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II
ABSTRACT OF
PLATINUM JUBILEE LECTURE

PLATINUM JUBILEE LECTURE

EDGE WAVES IN DOUBLE POROSITY ISOTROPIC SEMI INFINITE THIN PLATE UNDER PLANE STRESS CONDITIONS

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Abstract

Double porosity isotropic solid contains pores and fractures that contain distinct fluids. In this paper, first constitute relations; equations of motion, and non-dimensionalization in the case of said solids are presented. Next, the equations for plane stress problem are established. Finally, for illustration purpose, the results of wave characteristics of edge waves in semi infinite thin plate under plane stress conditions are presented. Because of nature of geometry, symmetric waves and anti symmetric waves are resulted. Frequency equations are derived for these waves. It is obtained that particle trajectory in the plane of plate is elliptical. From the numerical results it is inferred that phase velocity in the case of single porosity is higher that of double porosity.

Keywords: Double porosity, isotropic, plane stress problem, edge waves, phase velocity, wavenumber.

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III
ABSTRACT OF
INVITED LECTURE

ON LINEAR PATHWAYS OF COVID 19

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Abstract

SARS-CoV-2 is a novel virus unfortunately affecting human species in an unprecedented way. The novel coronavirus disease (COVID-19) spread continues to grow in most countries across the world. We observed that the nature of the pandemic spread is fractal. A simple analogy is a tree: It starts with a stem and as it grows it gets several branches. Time series data (number of deaths versus time) analyzed and intrigued to see that it follows a fractalbehaviour. In data driven model, the available data related to public is used to fit by a specific function; data is fitted through epidemiological models to estimate model parameters. Also, Fractals based model (Self similarity) is fitted to investigate the fractal nature of available data to understand whether data is chaotic or not to investigate long and short-term memory (LSTM) of the data. The fractal analysis of COVID-19 helps us to fit a suitable curve that can explain the data and provide short-term predictions and to know: how to flatten the curve. The physics of the model resembles the expansion of a flame in a homogeneous domain with a fractal dimension 3.7. After containment measures are taken, the natural fractal structure of the network is drastically altered and a secondary evolution is observed. This evolution, akin to the homogeneous combustion in a static isolated enclosure with a final quenching, has a characteristic time of 20.1 days, according to available data of the pandemic behaviour. The proposed model is remarkably consistent with available data, which supports the simplifying hypotheses made in the model. The epidemic trend generated as an outcome of RD-COVID-19 model. Results are in agreement with the result reported in the WHO dashboard. Future perspectives of this kind of study related to dynamic epidemiology will extend to compute risk management, including the cognitive behavior of humans facing this infectious disease under various control measures such as lockdown mainly and also social distance maintenance.

Keywords: Fractal, Brownian motion, RD-COVID 19, Epidemiological modeling, Hurst exponent.

CLASSIFICATION OF ASTEROIDS USING OPTIMIZATION ALGORITHMS OF MACHINE LEARNING

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Abstract

In recent years, machine learning is extensively used in the field of science and engineering for supervised and unsupervised learning. The Artificial Neural Network (ANN) is an sub domain of machine learning with the many hidden layers. The neurons in the input layer do not perform any computation, they are just used to hold inputs only. Each of the neuron is connected to the neuron of previous layer, receives information and passes it to the neuron in the next layer. Machine learning involves a cost function for the quantification of the expected outcomes. Generally mean squared error (MSE) and cross-entropy cost functions are used for this purpose. For minimizing the cost, gradient decent is the efficient optimization algorithm. In this algorithm, the model parameters (weights and biases) are adjusted to get the more accurate result close to the target output, this process is called the learning algorithm. We use backpropagation learning algorithm method which is an application of chain-rule of calculus. This algorithm carries information about the cost backward through the layers in the reverse order with aim to reducing the cost by adjusting the model parameters. The artificial neural networks with the three optimization algorithms namely: stochastic gradient decent (SGD), AdaGrad and Adam are used to classify asteroids in different classes. However, the network architecture, optimization algorithms and selection of activation functions are some key issues that affect the performance and generalization of a ANN model.

Keywords: Machine learning, Artificial Neural Network (ANN), Gradient Decent, Mean Squared Error (MSE), Asteroids

EVOLUTIONARY GAME THEORY ANALYSIS FOR NON-COOPERATIVE BEHAVIOUR OF ENTITIES IN A CLOSED-LOOP GREEN SUPPLY CHAIN

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Abstract

Pricing and green innovation efforts to develop more environmentally friendly products at competitive prices are significantly influenced by the decentralized behaviour of organisations in a green supply chain. A key element of reducing carbon emissions caused by producing goods and recycling is government intervention (subsidies for green industry, cap-and-trade policy, etc.). In this lecture, we'll talk about how supply chain participants act in a decentralised manner over the long term and how the government decides whether to step in when retailers compete on price and sales effort. More specifically, using an evolutionary game theoretic method, we will discuss non-cooperative behaviour of price and sales effort competing retailers with the manufacturer under government intervention. We will the extend the proposed model to analyse the evolutionary behaviour of government, regardless of whether it intervenes in the same circumstance or not. An important finding of our study is that, in such a scenario, government intervention is always advantageous regardless of what the supply chain chooses. Our analysis shows that the population of retailers adopts the retailer leader Stackelberg strategy to deal with the manufacturer. The numerical results further show that, in contrast to the vertical Nash scenario, when retailers dominate the market, it is advantageous for both retailers and the entire supply chain. Environmental performance of the product also improves.

MODELING APPROACH FOR ASSESSING GROWTH TRAJECTORIES WITH LONGITUDINAL DATA

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Abstract

The assessment of human growth required serial data collections which results into longitudinal data. To determine the growth and assess the health of children their body size parameters such as height and weight are measured over a period of time. The size varies based on age at the time of measurements and also differs between sexes. Aim of this paper is to understand and predict the growth of the child by using body size parameters and also estimate their age at peak velocity and peak velocity using SuperImposition by Translation And Rotation (SITAR) model.

The present paper employs height and weight body size parameters measured during annual health check-up of 12065 participants from 5 years to 15 years of age. Of them 6804 (56%) were boys and 5261 (44%) were girls. On use of SITAR model, it is observed that the mean age at peak height velocity is 13.20 years for boys and 9.12 for girls. Similarly, the mean age at peak weight velocity is 11.11 years for boys and 10.44 years for girls. Furthermore, the mean peak height velocity is 6.96 cm/year for boys and 6.62 cm/year for girls. Similarly, the mean peak weight velocity is 5.44 kg/year for boys and 4.73 kg/year for girls. Moreover, the mean age at peak BMI velocity is 5.26 kg/m^2 per year for boys and 9.08 kg/m^2 per year for girls. Furthermore, the mean peak BMI velocity is 0.58 kg/m^2 per year for boys and 0.62 kg/m^2 per year for girls. Individual and combined models for height and weight showed more than 90% of the variance. Fitting separate SITAR models for body size parameters confirmed SITAR's good fit and highlights the spectrum

of growth patterns. Thus, SITAR seems to work well to understand the growth patterns among children.

Keywords: Growth data, SITAR model, Age at peak velocity, Peak velocity.

A UNIFIED STABILITY ANALYSIS OF SOME DOUBLE-DIFFUSIVE CONVECTION PROBLEMS

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Abstract

A class of results in the eigenvalue problems from the domain of linear hydrodynamic and hydromagnetic stability theory is derived by multiplying the governing differential equations by the conjugate eigenfunction and integrating the resulting equations over the range of independent variables for a suitable number of times with the help of boundary conditions. Despite the similar mathematical structure of the eigenvalue problems and derivation mechanism, each of these problems *hitherto* has been treated as a particular problem and various steps taken in the stability investigations of these problems appear to be *adhoc* and unrelated. Moreover, some generalized system of eigenvalue problems governing double-diffusive convection problems with cross-diffusion effects (Dufour and Soret effects) represented by the system of differential equations together with a set of boundary conditions contains coupling amongst the eigenfunctions, which inhibit the trivial extensions of the results obtained for single/double-diffusive convection problems for general boundary conditions.

In this presentation, the relations amongst the eigenvalue problems describing, the Bénard convection problem, Veronis& Stern types Thermohaline convection problems, Modified Thermohaline convection problem, and Double-Diffusive convection problem with cross-diffusion effects are elucidated. A generalized setup of the eigenvalue problems, termed as *Generalized Double-Diffusive Convection Problem,* is constructed by utilizing some ingenious linear transformations for a unified treatment for stability investigations of these problems. Certain known and new results concerning the stability or otherwise of the problems are derived and deduced, from this otherwise generalized setup of the eigenvalue problem. Various other aspects of linear hydrodynamic stability are also discussed.

Keywords: Hydrodynamic stability, Eigenvalue problem, Bénard problem, Thermohaline convection, double-diffusive convection, Cross-diffusion effects,

MHD ELASTICO-VISCOUS THERMAL BOUNDARY LAYER FLOW: AN OVERVIEW

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Abstract

The present analysis exemplifies the flow feature of elastico-viscous fluid which continues to seize substantial admiration due to its enormous consequences in manufacturing and engineering processes. This type of fluid is consequential in chemical and process industries as they encounter both viscous and elastic attributes manifested by most polymers and biological fluids. Many processes of realistic significance are controlled by an elastico-viscous boundary layer which refers to a thin layer of fluid next to the solid wall in a high Reynolds number. The temperature distribution within the thermal boundary layer region due to the flow of an elastico-viscous fluid around a heated fixed circular cylinder maintained at a constant temperature higher than that at infinity in the presence of a magnetic field has been contemplated near the forward stagnation point. Due to the elasticity of the fluid, the point of separation is found to shift towards the forward stagnation point. The growth of the magnetic parameter enhances the value of the separation point in both viscous and elastico-viscous fluid. Furthermore, the velocity, as well as temperature fields, are appreciably pretentious by visco-elasticity.

Keywords: MHD, Elastico-viscous, Boundary Layer, Reynolds Number, Point of Separation.

VELOCITY BEHAVIOR OF THE RAYLEIGH WAVES IN TWO LAYERED NONLOCAL ELASTIC MODEL

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Abstract

This paper investigates the propagation of Rayleigh waves in a model consisting of a non-local elastic dry-sandy layer overlying an incompressible non-local porous semi-infinite stratum under the effect of a rigid boundary on the surface of the model. Initially, the Rayleigh wave field is investigated with an interior initial condition in a semi-infinite medium. Later on, displacements and stresses continuity conditions at the interface and zero displacement conditions on the free surface yield a complex dispersive relation of the Rayleigh wave. It is also analyzed numerically using MATLAB software. The effect of the non-local elasticity, sandy parameter, and porosity parameter of the velocity curve is depicted graphically and compared with the existing results. Further, the obtained dispersion relation is compared with the dispersion relation with the local elastic stratum of the same model. The model developed creates an insight into the practical seismological problems involving non-local elasticity.

Keywords:

Rayleigh waves, Non-local elasticity, Porosity, Sandiness, Helmholtz decomposition, Dispersion, Damped velocity

PLANE WAVES IN NONLOCAL THERMOELASTICITY II

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Abstract

The generalized thermoelasticity theory based upon the Green and Naghdi model II of thermos elasticity as well as the Eringen's nonlocal elasticity model is used to study the propagation of harmonic plane waves in a nonlocal thermoelastic medium. We found two sets of coupled longitudinal waves which are dispersive in nature and associated with attenuation. In addition to the coupled waves, there also exists one independent vertically shear type wave which is dispersive but without any attenuation. All these waves are found to be influenced by the elastic nonlocality parameter. Furthermore, the shear type wave is found to be associated with a critical frequency, while the coupled longitudinal waves may have critical frequencies under constraints. The problem of reflection of the thermoelastic waves at the stress-free insulated and isothermal boundary of a homogeneous, isotropic nonlocal thermoelastic half-space has also been investigated. The formulae for various reflection coefficients and their respective energy ratios are determined in various cases. For a particular material, the effects of the angular frequency and the elastic nonlocal parameter have been shown on the phase speeds and the attenuation coefficients of the propagating waves. The effect of the elastic nonlocality on the reflection coefficients as well as the energy ratios has been observed and depicted graphically. Finally, analysis of the various results has been interpreted.

CONSTRUCTION AND SMOOTHNESS ANALYSIS OF HERMITE INTERPOLATORY SUBDIVISION SCHEMES

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Abstract

Computer Aided Geometric Design (CAGD) originated in naval engineering and automotive and aircraft industries. Later, it found many relations in other branches of mathematics, as well. At, present, CAGD tools are applied to other areas of engineering and industry as well as to terrain modelling, medicine and life sciences. CAGD is a discipline which deals with geometrical objects like curves and surfaces. Subdivision schemes are efficient and easy to implement tools that helps to construct such geometrical objects globally and to study their properties in a very easy manner. Generally, a subdivision scheme is an iterative scheme which generates denser and denser set of data points from a finite set of initial data points by implementing an average rule. The averaging rules are such that after few iterations these dense data set will lie on a smooth curve or surface. In starting years, subdivision schemes are developed to take care of function values only. Some well-known schemes of such kind are Chaikin-subdivision, DLG-subdivision, Riesenfeld-Subdivision etc. Later, the subdivision schemes are made powerful by introducing vector subdivision schemes. Recent trends in subdivision schemes are Hermiteinterpolatory subdivision scheme (Hermite scheme) in which not only function value but also data of higher order derivatives are considered. These are special kind of vector subdivision scheme in which data are organized into function data and derivative data. These Hermite schemes prove to be more useful since the shapes like monotonicity, convexity, positivity etc are well studied. In this talk, we go through constructing several widely used Hermite schemes like C1-Merrien, C2-Merrien, [2/2], [3/2], and [5/4] schemes. To study their convergence and the smoothness we outline famous approaches introduced by Dyn, Merrien and Kuijt. Later, we apply these schemes to shape preserving interpolation and we show their approximation power numerically. In conclusion some recent references are given to the research community.

Keywords: Iteration, Hermite Subdivision scheme, Interpolation, Monotonicity, Convexity, Smoothness, Approximation power, Rational Bernstein Bezier Curve.

ALTERNATE SUPERIOR BAPTISTA CHAOTIC CRYPTOSYSTEM

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Abstract

Baptista algorithm is one of the fundamental chaotic cryptographic algorithms. We look into the security issues in Baptista's chaotic cryptosystem raised by different researchers. The talkfocusses on two problems of Baptista algorithm: non-uniform distribution of chaotic data and use of single attractor. We use *PS* algorithm and superior logistic map in Baptista algorithm which adds a few more parameters in the secret key. The two proposed methods use more uniform chaotic data and two chaotic attractors respectively, which in turn increases the security features of Baptista cryptosystem by taking high numbers of iterations for encryption.

BASICS OF DYNAMICAL SYSTEMS

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Abstract

We shall discuss basics of dynamical systems. Classification of dynamical system will be described. There are seven empirical laws by Kepler and Newton. The entire structure of Celestial Mechanics is based on these fundamental laws. Three body problem is unsolved till today. Hence, we put some restriction to three body problem. This is known as Restricted Three-Body Problem. We shall establish the equations of motion and try to find its solutions. There are five particular solutions. Finally, we discuss the stability of solutions which is an important aspect in the study of celestial mechanics. There are two types of particular solution, one is equilateral triangular solutions and the other is called collinear solutions. The collinear solutions lie on X-axis denoted by L_1, L_2 and L3. They are unstable. The equilateral triangular solutions are denoted by L_4 and L_5. They are stable under certain condition. They lie on the vertices of an equilateral triangle. We shall think over the weakness of basic laws. We consider mass variation in space. It is not constant, but variable. Hence the dynamics of the system will change. In 1983 we proved that mass is variable and result was published in the journal “Celestial Mechanics”. Effect of oblateness of Earth be taken into account. It is an oblate spheroid. Similarly, effect of radiation on the motion of satellite be considered. Fundamentals of Gravitational laws must be understood.

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IV
ABSTRACT OF
ORAL / POSTER PRESENTATION

SOME HERMITE SUBDIVISION SCHEMES AND THEIR COMPARISON

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Abstract

Subdivision schemes are iterative schemes that use average algorithms to generate denser and denser sets of control points starting from a finite set of control points. In the limit, these dense sets of control points eventually lie on a smooth function. This function may be a curve or a surface. Hermite Subdivision Schemes have advantages over other subdivision schemes because they take care of first order and other higher order derivatives. In addition to this, they can be desired to have shape-preserving properties like monotonicity and convexity. Hermite Subdivision schemes date back to 1992 when Merrien introduced a Hermite scheme that followed a bisection algorithm. Now there are lots of literature on the Hermite Subdivision Scheme available to the subdivision community. Some of the recent works include the work of Jena who has published works on 2/2, 3/2 and 5/4 rational Hermite schemes. In this paper, the author tries to compare different C^1-Merrien scheme, C^2-Merrien scheme, and Rational [5/4]-scheme among themselves and also with the Cubic spline method. The comparison is based on smoothness, shape preserving capability, and order of approximation. Finally, a conclusion is given based on the comparisons.

Keywords: - Hermite Subdivision Scheme, Bezier curve, Convergence, Monotonicity, Convexity, Order of Approximation

BIANCHI TYPE V COSMOLOGICAL SCENARIO IN $f(R,T)$ GRAVITY THEORY

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Abstract

Here we have studied, the exact solutions of the field equations in respect of Bianchi type V universe filled with bulk viscous fluid in the framework of $f(R,T)$in the form $f(R,T) = R + 2f(T)$, where R and T are respectively Ricci scalar and trace of energy momentum tensor. We have made use of the mixture of exponential and hyperbolic scale factor to find the physical parameters and metric potentials defined in the space-time. The geometrical and physical parameters of the model are studied. The energy conditions of the model are also studied. The state finder diagnostic pair is found to be in the acceptable range.

Keywords:$f(R,T)$ gravity, Bianchi type V,Bulk viscous fluid, deceleration parameter.

ISOTROPIC BACKGROUND FOR LOGAMEDIATE $f(T)$ GRAVITY

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Abstract

In this paper, the authors examine the accelerated expansion of the Universe in the framework of $f(T)$ gravity theory, in which the torsion scalar (T) describes the gravitational interaction. To find the solution of the field equations in the FLRW Universe, we propose the scale factor called logamediate scale factor. The evolution of the deceleration parameter indicates a transition from the deceleration to the acceleration phase of the Universe. In addition, we investigate the behaviour of the statefinder (r, s) diagnostic parameter. Further, to discuss other cosmological parameters like energy density, pressure, equation of state parameter, energy conditions in details we consider some different forms of $f(T)$ gravity models.

Keywords: FRW Model, Logamediate scale factor, $f(T)$ gravity.

EXISTENCE AND UNIQUENESS OF R-L FRACTIONAL DIFFERENTIAL EQUATIONS WITH INITIAL TIME DIFFERENCE

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Abstract

Existence and uniqueness results of Riemann-Liouville (R-L) fractional differential equations with initial time difference are obtained. Monotone technique is developed to obtain existence and uniqueness of solutions of R-L fractional differential equations with initial time difference.

Keywords: Initial time difference, Monotone technique, Existence and uniqueness.

CRANK-NICOLSON DIFFERENCE SCHEME FOR SOLVING SPACE FRACTIONAL CONVECTION DIFFUSION EQUATION

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Abstract

The purpose of this article is to formulate the Crank – Nicolson difference scheme for the solution of Space Fractional Convection Diffusion Equation (SFCDE). For this scheme the Stability as well as convergence is established. One example is presented for the accuracy and efficiency of the scheme. Its solutions are represented graphically by Mathematica software.

Keywords: Fractional Convection Diffusion Equation, Crank – Nicolson difference scheme,Stability, Convergence, Mathematica.

TO STUDY THE CHANGES IN THE PERFORMANCE MEASURES OF THE SINGLE SERVER FINITE SOURCE QUEUING MODEL WHEN CONVERTED TO MULTIPLE SERVERS FINITE SOURCE QUEUING MODEL

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Abstract

A queuing model where the queue length is increasing with the time although the calling population is limited, customers are frustrated and not satisfied with the service. To overcome this problem, there should be making some fruitful changes in the system. One of the changes is to increase the number of servers. Here we study the changes in the value of the queuing parameters of finite source queuing model by increasing the number of server in the queuing system. With this change there is valuable improvement in the system. Waiting time of customers in the queue and system reduces.

Keywords: Average arrival rate, Average service rate, Utilization factor, Waiting time of customer, Number of customers, Number of servers.

GLOBALSTABILITYANALYSISOFSIQR-QS-QIMODEL

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Abstract

In this paper, we have constructed a compartmental model and analyzed its stability when quarantine populations are allowed to mix with infectious and susceptible populations. Here the local and global dynamics of the population model are investigated. Result shows that the disease free equilibrium point and endemic equilibrium point are locally asymptotically stable. Further Lyapunov functions are constructed for both the equilibrium points. It is also established that both thee quilibrium points are globally asymptotically stable.

Keyword: Equilibrium point; Stability; Reproduction No.; Lyapunov Function.

NUMERICAL AND THEORETICAL ANALYSIS OF THE PARABOLIC PARTIAL DIFFERENTIAL EQUATION THROUGH BERNOULLI WAVELET COLLOCATION SCHEME

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Abstract

We present a novel scheme called Bernoulli wavelet collocation method for the parabolic partial differential equations (PDEs) with different boundary conditions. First, we developed the functional matrix of integration through the concept of the linear combination of basis, then the Bernoulli wavelet collocation scheme has been generated with the help of the Newton Raphson technique. With the help of the above method parabolic PDEs are converted into a system of algebraic equations, on solving these equations that yield desired approximate solution. In this article, we solved some problems to justify the current approach. The obtained results are discussed through the tables and graphs. Also, these results are compared with results available in the literature. Convergence analysis for the proposed technique is drawn in terms of the theorem.

Keywords: parabolic partial differential equations; Functional matrix of integration; Collocation method; Bernoulli wavelets, Newton Raphson technique.

LRS BIANCHI TYPE II MAGNETIZED STRING COSMOLOGICAL MODEL WITH BULK VISCOUS FLUID IN ROSEN'S BIMETRIC GRAVITY

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Abstract

We have presented the solution of LRS Bianchi type II space-time with magnetic field and with string viscous fluid by solving the field equations of Rosen's bimetric theory of gravitation. It is observed that the magnetic field could have the cosmological origin of the model and it is agreed with Harrison (1973). The small value of magnetic field originated the universe and evolving it with maximum density and ending with zero density. The strong magnetic field ruled out the existence of the universe. Other geometrical and physical behavior of the model have been studied in the evolution of universe.

Keywords: Gravitation theory, Magnetic field and Cosmology.

HYGROTHERMAL BUCKLING ANALYSIS OF EXPONENTIAL FUNCTIONALLY GRADED PLATES BASED ON CLASSICAL PLATE THEORY

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Abstract

The hygro-thermal effects on buckling analysis of Exponential functionally graded plates are discussed in this paper. Equilibrium and stability equations of a rectangular E-FGM plate under hygro-thermal loads are derived by using approximate solution obtained by application of Fourier series, based on the classical plate theory. Effects of various parameters like, thickness ratio and aspect ratio on critical linear buckling temperature rise for temperature independent and dependent material properties and effect of critical linear moisture for different moisture concentrations are discussed. Numerical results for critical linear buckling temperatures and critical linear moisture of FGM are computed numerically and illustrated graphically.

Keywords: Temperature, buckling, hygrothermoelasticity, Functionally Graded Materials, moisture concentration.

AN END-TO-END CATEGORIZING PROCESS BASED ON RENEWABLE ENERGY SOURCES: INTERVAL VALUED Q-RUNG ORTHOPAIR FUZZY MADM APPROACH

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Abstract

In today's world, people's need for energy is crucial. In India, people utilizing 73% of electricity from fossil fuels is the biggest hazard to the environment. In order to partly gratify the nation, policymakers have decided to invest in renewable energy sources rather than non-renewable resources for the production of energy. There five distinct kinds of green energy sources. The research key contribution is selecting the best renewable energy sources among the five different categories. Therefore, here we form a mathematical fuzzy model to identify the decision received from hesitating knowledge in the form of an Interval-valued q-rung orthopair fuzzy set (IVq-ROFS) is used to handle the uncertain data in decision makers' thoughts. A gathering of relevant judgement Multi-Criteria Decision Analysis (MCDA) is employed. Attributes play a prominent role in DM for ranking the alternatives. Here we have twelve attributes and five alternatives. An objective entropy method is employed for weight determination and an EDAS (Evaluation Based on Distance from Average Solution) method is determining the alternative from the distance measure between each alternative and Novel methodology. Ultimately, to validate the proposed results, compared the proposed results with other existing MCDA method results.

Keywords: Fossil fuels, Renewable energy, IVq-ROFS, Entropy, MCDA and EDAS

BIANCHI TYPE-I ANISOTROPIC DARK ENERGY MODELS WITH CONSTANT DECELERATION PARAMETER IN LYRA GEOMETRY

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Abstract

In this paper, we examine anisotropic Bianchi type-I cosmological dark energy model with constant deceleration parameter in Lyra geometry. We discuss the model in power law expansion and in exponential law expansion. In power law shows that at initially, universe start with constant volume and expand exponentially and approaching infinity. However, in exponential law shows that the model starts with constant volume and then expanding exponentially to infinity. We explore both flat and curved universe, for accelerating and decelerating expansion. The other geometrical and physical properties of each model is studied.

Keywords: Dark Energy, Dark Matter

THERMOSOLUTAL CONVECTION IN ELASTICO-VISCOUS RIVLIN-ERICKSEN NANOFLUID WITH POROUS MEDIUM

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Abstract

The current study investigates the effects of rotation and magnetic field on Rivlin-Ericksennanofluid in a porous medium heated from below. Thermophoresis and Brownian motion phenomena are also considered in this nanofluid model. The conditions for the commencement of convection is determined using the linear stability theory. In the analytical and numerical analysis, the impacts of the thermo-nanofluid Lewis number, Taylor number, modified diffusivity ratio, medium porosity, nanoparticle Rayleigh number, solutal Rayleigh number, Soret and Dufour were examined. The conditions for the lack of oscillatory convection are also satisfied.

Keywords: Magnetic Field, Porous Medium, Rotation, Thermosolutal Instability

STUDY OF MODIFIED EQUATION OF STATE WITH MASSIVE SCALAR FIELD IN GENERAL RELATIVITY

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Abstract

In the present study, we have analysed role of modified equation of state with scalar field in the framework of Bianchi type-V in general relativity. Here we considered the relation between expansion scalar is proportional to shear scalar. In this paper, we have investigated physical and kinematical parameter like Hubble parameter (H), deceleration parameter (q), density (ρ), pressure (p), bulk viscosity(ζ) etc. Finally we have summarized with the discussion of cosmological perturbation of the resultant model. The results studied in this work are consistent with recent observations.

Keywords: Bianchi type-V cosmology, Modified EoS, Bulk Viscosity

MODELLING OF LOVE-LIKE SURFACE WAVE IN A HOMOGENEOUS-COATED POROELASTIC ANISOTROPIC STRATUM WITH SLIDING CONTACT AND POINT SOURCE EFFECT

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Abstract

This study aims to determine the effect of varying depths of point sources in a layered stratum with the effect of the sliding layer's contact on the Love-like wave propagation. The model's geometry is considered a fluid-saturated anisotropic porous layer sandwich by a finite thickness layer and non-homogeneous elastic half-space. Green's function and Fourier transform techniques are applied to obtain the analytical solutions for the geometric model. The dissipation of the porous medium and two different sliding parameters are considered to show the effect of the layer's sliding due to the propagation of the wave. It has been observed that the depth of the point source has a negligible effect in the non-homogeneous medium and the opposite nature of the effect of two sliding parameters on the phase velocity.

Keywords: Lovewave, Point source, Dissipation, Sliding contact, Dispersion

SYMMETRIES AND LIE ALGEBRA OF RAMANUJAN EQUATION

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Abstract

Symmetry analysis of Ramanujan's system of differential equations is performed by representing it as a third-order equation. A new system consisting of a second-order and a first-order equation is derived from Ramanujan's system. The Lie algebra of the new system is equivalent to the algebra of the third-order equation. This forms the basis of our intuition that for a system of first-order odes its infinite-dimensional algebra of symmetries contains a subalgebra which is a representation of the Lie algebra for any system or differential equation which can be obtained from the original system, even though the transformations are not point.

Keywords: Symmetries; Integrability; Increase of order.

EXISTENCE AND UNIQUENESS OF R-L FRACTIONAL DIFFERENTIAL EQUATIONS WITH INITIAL TIME DIFFERENCE

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Abstract

Existence and uniqueness results of Riemann-Liouville (R-L) fractional differential equations with initial time difference are obtained. Monotone technique is developed to obtain existence and uniqueness of solutions of R-L fractional differential equations with initial time difference.

Keywords: Initial time difference, Monotone technique, Existence and uniqueness.

EXISTENCE AND UNIQUENESS OF SOLUTION FOR SYSTEM OF FRACTIONAL NONLINEAR BOUNDARY VALUE PROBLEMS

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Abstract

In this paper, the existence and uniqueness of solution for system of fractional non-linear boundary value problems is investigated using Green's function and Banach contraction principle.

Keywords: Riemann-Liouville fractional derivative, Green's function, Existence and uniqueness of solution, Banach contraction principle.

NORMALISED THREE PARAMETRIC BI-MEASURE OF ENTROPY, DIRECTED DIVERGENCE, INACCURACY

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Abstract

Different Motivations For Normalising A New Three Parametric Bi-Measure Of Entropy, Directed Divergence, Inaccuracy Have Been Proposed By Simultaneous Use Of The Generalisations Of Shannon's Measure Of Entropy Due To Kapur's And Havrda And Charvat's Measures Of Entropy Are Also Discussed For Same Objective And Their Properties Have Been Discussed.

Keywords -Normalised Measure, Measure of Entropy, Directed Divergece, Inacuracy Bi-measure of Entropy, Additive, Concave.

ANALYTICAL SOLUTION OF PRICE ADJUSTMENT EQUATION INVOLVING CONSTANT PROPORTIONAL CAPUTO DERIVATIVE BY SUMUDUTRANSFORM

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Abstract

An attempt is made to obtain analytical solution of price adjustment equation involving constant proportional Caputo fractional derivative. Price adjustment equation with and without prospects of agents is considered in the study under equilibrium condition. Sumudu transform method is applied to obtain analytical solution of price adjustment model involving constant proportional Caputo derivative. Analytical solution of price adjustment equation with suitable parameters is obtained and are simulated using MATLAB.

Keywords: Sumudutransform, Demand and Supply, Price adjustment equation, Market Equilibrium, Fractional Differential Equations.

FUZZY TOPSIS ALGORITHM FOR THE EVALUATION OF STUDENT'S PERFORMANCE IN UNIVERSITY LEVEL DEBATE COMPETITION: MODEL DEVELOPMENT & APPLICATION

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Abstract

In today's educational system, apart from conventional classroom education, practical exposure to the students is considered to be more crucial for improving their skills and knowledge. For this, debate competition is one of the ways by which student can retain and explore the knowledge of the topic learned. The decision making by group of decision makers in the assessment of students is often based on crisp data which involves uncertainty. This uncertainty can be minimized by making use of fuzzy environment. In this paper, a multi-criteria decision making based simplified fuzzy technique for order preference by similarity to ideal solution (Fuzzy TOPSIS) model is developed and applied to rank the students participating in university level debate competition. Various criteria and alternatives are determined and evaluated by group of decision makers and results are reported. Results are obtained and compared with actual crisp data for the effective application of the fuzzy model.

Keywords: Fuzzy TOPSIS, Student, Evaluation, Performance, Multi-Criteria Decision Making

FIXED POINT THEOREMS FOR ONE TYPE OF WEAK-GENERALIZED F-CONTRACTIONS ON A B-METRIC-LIKE SPACE AND IT IS APPLICATIONS TO SOME TRIGONOMETRIC FUNCTIONS ON $\left[0, \frac{\pi}{2}\right]$

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Abstract

In this paper, we study one type of weak-generalized F-contractions on b-metric-like spaces and it is applications to trigonometric functions. we prove some fixed-point theorems for F-contractions. We study some generalizations from previous literature by clarifying one example to support our results.

TRAFFIC LIGHT CONTROLLER FOR SMART CITIES USING FUZZY LOGIC

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Abstract

Today, the smart cities are very much affected due to traffic jam and traffic signal controller is the best approach to solve the traffic jam problems. Since the existing signal controllers are not sufficient to give the appropriate solutions of these type of traffic problems. So, in this paper, a traffic light controller using fuzzy logic is introduced to solve the traffic jam problems. In this controller, there are four inputs and two outputs of several linguistic variables.

Keywords: Linguistic Variables, Membership Functions, Triangular Membership Functions (TMF), Fuzzification, Defuzzification.

A TRAVELLING EDGE WAVE ON A NON-HOMOGENEOUS SANDY PLATE SUPPORTED BY THE WINKLER FOUNDATION

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Abstract

A travelling flexural wave along the edge of a thin semi-infinite sandy plate is analyzed. The differential form of then on-local elasticity is considered to investigate the micro-scale effect on the sandy plate supported by the viscoelastic Winkler foundation. The Kirchhoff plate theory is used to formulate the plate bending equation for this model. Due to the presence of viscosity in the foundation, a complex form of the dispersion relation is obtained. Analytical solutions indicate the dependency of dispersion of the flexural edge waves on the sandy parameter and the density index of the plate.

Keywords: Sandyplate, Non-localelasticity, Foundation,Viscosity, Edgewave.

EFFECT OF THE RADIATION PRESSURE ON THE EQUILIBRIUM POINTS IN BIELLIPTIC RESTRICTED FOUR BODY PROBLEM

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Abstract

The motion of an infinitesimal mass in the restricted four body problem is studied assuming both the orbits of motion of the three primaries to be elliptical. It is assumed that the forces governing the motion of the bodies is the mutual gravitational attractions of the primaries as well as the radiation pressure due to the largest primary. We have derived the equations of motion. The location of the planar equilibrium points is studied for Sun-Earth-Moon system and graphically presented.

Keywords: BiElliptical Restricted Four ody Problem, Equilibrium points, Radiation pressure.

NUMERICAL AND THEORETICAL ANALYSIS OF THE PARABOLIC PARTIAL DIFFERENTIAL EQUATION THROUGH BERNOULLI WAVELET COLLOCATION SCHEME

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Abstract

We present a novel scheme called Bernoulli wavelet collocation method for the parabolic partial differential equations (PDEs) with different boundary conditions. First, we developed the functional matrix of integration through the concept of the linear combination of basis, then the Bernoulli wavelet collocation scheme has been generated with the help of the Newton Raphson technique. With the help of the above method parabolic PDEs are converted into a system of algebraic equations, on solving these equations that yield desired approximate solution. In this article, we solved some problems to justify the current approach. The obtained results are discussed through the tables and graphs. Also, these results are compared with results available in the literature. Convergence analysis for the proposed technique is drawn in terms of the theorem.

Keywords: parabolic partial differential equations; Functional matrix of integration; Collocation method; Bernoulli wavelets, Newton Raphson technique.

NUMERICAL COMPUTATION OF NATURAL CONVECTION OF NANOFLUID IN AN OPEN WAVY POROUS CAVITY HEATED PARTIALLY

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Abstract

In this work, we emphasise the heat transfer and fluid flow due to buoyancy force in a wavy open porous cavity, placed horizontally having filled with porous media and, its top wall is being kept open, whereas the right cold wall is wavy and, its left vertical wall is heated partially, keeping all other walls at thermally insulated. The nondimensional stream function-temperature formulation of mass, momentum, and energy conservation laws for porous media are solved by the standard finite difference scheme for a wide range of pertinent parameters such as nanoparticle volume fraction (0.05 – 0.2), Rayleigh-Darcy number (10 - 10^3), length of heat source (0.25 – 1.0), and parameters controlling waviness of right wall ($1 \leq N \leq 5$) and amplitude ($0.05 \leq a \leq 0.25$). The simulated results are presented in the form of streamlines and isotherms; global and local Nusselt numbers are computed, and obtained results are analysed and it is observed that the convection process is augmented at the presence of nanoparticle for low Ra but decreases at high Ra for all pertinent parameters.

Keywords: Finite difference method, Natural convection, Nanofluid, Porous media, wavy cavity.

EVALUATION BY USING ANONYMIZATION METHOD OF PRIVACY PRESERVATION TECHNIQUES WITH AN EFFICIENT APPROACH AND A SYSTEMATIC COMPARISON

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Abstract

Data is ceaselessly being gathered because of the inescapability of consistently associated gadgets and the pervasiveness of Internet of Things advancements in individuals' lives. IoT gives the interconnection between different heterogeneous gadgets and sensors that can screen and accumulate a wide range of information about machines and human public activity. Notwithstanding the advantages that can emerge out of gathering information, clients are uncovering touchy and confidential data with perhaps deceitful elements. The tremendous measure of information being gathered about people has brought new difficulties in protecting their security when this information is scattered. Therefore, Protection Saving Information has turned into a functioning examination region, wherein numerous anonymization calculations have been proposed. Notwithstanding, given the huge number of calculations accessible and restricted data with respect to their presentation, it is challenging to distinguish and choose the most proper calculation given a specific distributing situation, particularly for specialists. Here, we play out a precise correlation of notable k-anonymization calculations to gauge their proficiency and their viability. These substances can process, take apart and mine data to remove important information, yet furthermore sell or possibly share the assembled data with pariahs, using it harmfully. With the creating number of maltreatment of data and data breaks, insurance has been another subject and serious security concerns have been animated. To resolve these issues, various Privacy-Preserving Mechanisms (PPMs) and instruments have been proposed.

Keywords : Pervasiveness, Privacy preserving, Anonymization

SHULVA SUTRA - A GEOMETRICAL INTERPRETATION

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Abstract

The Sulbasutras are appendices to the Vedas, in which some sections contain the geometry required for designing and constructing the fire altars. If the ritual sacrifice was to be successful then the altar had to conform to very precise measurements.The earliest is a sutra attributed to Baudhayana, which was authored between 800 and 500 BCE.

In this paper, I will explain a method based on the *Sulba sutra* (Sanskrit texts by the Vedic scholars before 600 B.C.) To find the numerical value of square roots, this method is applicable for many numbers and gives almost accurate results with very ease and less calculations.

Key Words - Shulva Sutra , Baudhayan, Katyayan, Fire- alter.

THERMAL ANALYSIS OF AN ANNULAR FIN WITH TEMPERATURE-DEPENDENT THERMAL CONDUCTIVITY AND HEAT GENERATION BY USING DTM-PADE APPROXIMATION

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Abstract

The main aim of present investigation is to analyze the thermal behavior and thermal stresses of an annular fin by considering the temperature-dependent thermal conductivity and internal heat generation with help of DTM-Pade approximation. The energy equation is converted into a nonlinear ordinary differential equation (ODE) by using non-dimensional parameters and subjected to DTM-Pade approximation to obtain the approximate analytical solution. Furthermore, the impact of several parameters on the temperature field is examined graphically. It is noted that temperature distribution enhances with an upsurge in the heat generation parameter. The growing values of thermo-geometric parameter elevate the efficiency of the fin.

Keywords: Annular fin; DTM-Pade approximant method; Heat generation

SECOND ORDER NONCANONICAL DIFFERENCE EQUATIONS WITH SUBLINEAR NEUTRAL TERM: IMPROVED OSCILLATION CRITERIA

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Abstract

The present discussion is to study the following second order nonlinear delay dynamic equation of the form:(0.1) under the assumption. We divide the research into two halves, and, and look for some lim sup type conditions that cause all solutions to oscillate. Our findings basically improve, and simplify certain previously published results. We give an answer to question raised in [2, Remark 4.1]. To illustrate the analytical findings, two examples are provided. Clearly, our results improved or generalised the work of Dinakar et al. [4], Seghar et al. [5] and Thandapani et al. [6]. Finally, we define two open problems for future research.

Keywords: Oscillation, non-oscillation, neutral difference equation, sublinear, non- canonical form.

DATA ENCRYPTION TO DECRYPTION BY USING LAPLACE TRANSFORM

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Abstract

In this paper, we introduce an encryption and decryption procedure with high security by mathematical model, using Laplace transformation and Inverse Laplace Transformation for the given transforming data from one end to other end. We also give an example. Here we convert plain text to ASCII code. We take two primes as a primary key for encryption and decrypt in of the original data.

Keywords: Encryption, Decryption, Cipher text, Laplace transformation, Inverse Laplace transformation, ASCII code.

COMPETENT NOVEL STRATEGIES FOR STRONG CONVERGENCE WITH VARIATIONAL INEQUALITY AND SPLIT EQUALITY CRISIS IN FIXED POINT THEORY

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Abstract

The proposed work introduces the competent novel strategies, initially that include new Hotchpotch Correlation Approach for solving the Variation Inequality Problem and finding the fixed point of demi contractive mapping. After solving the VIP and fixed points problem, more essential to decipher a split equality convex minimization crisis, the research incorporates Estrangement Corollaries Algorithm. In order to resolve the non-regularization of transport problem, the research includes an insinuated province theorem with essential and adequate idyllic conditions. The theorem derive the restrict distributions amongst probability distributions endorsed on a fixed metric space and focusing on specific consistency including its bootstrap for empirical regularized optimal transport distances. In particular, the work reveals that a Gaussian law is asymptotically followed in the empirical regularized transport plan system. The theory involves the regularization of considerable entropy and thus a limitation law for the extensively permissible Sinkhorn divergence.

Keywords : Hotchpotch Correlation Approach, Variation Inequality Problem, Estrangement Corollaries Algorithm, Insinuated province theorem

CONSTRUCTIONS OF MAXIMUM DISTANCE SEPARABLE RHOTRICES OVERFINITE FIELDS

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Abstract

Maximum Distance Separable (MDS) matrices are used extensively in Cryptography and coding theory. A rhotrix can be represented in the form of coupled matrices and this property of rhotrices is used to double the security of the cryptosystems. Here, we have defined Pascal –like rhotrices and used them to construct maximum distance separable rhotrices over finite fields.

Keywords: Pascal Matrix; Pascal-like rhotrix; Maximum distance separable rhotrix; Finitefields.

EXACT SOLUTION OF MULTILAYERED ANNULAR DISC OF STEADY-STATE PROBLEMS OF TEMPERATURE AND THERMAL STRESSES.

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Abstract

In this paper, an attempt has been made to solve problems of thermoelasticity and determine the unknown temperature, displacement and stress components of multilayered annular disc. In this paper the zero temperature is maintained on the curved surfaces and third kind boundary condition is maintained on the upper surface and zero temperature is maintained on lower surface. The governing heat conduction has been solved by using finite Hankel transform technique. The results are obtained in series form in terms of Bessel's functions and have been computed numerically and illustrated graphically.

Keywords: Multilayered Annular Disc, Steady- state, Thermoelastic problem, Hankel transform.

ANALYSIS OF FRACTIONAL GAS DYNAMIC EQUATIONS USING ATANGANA-BALEANUE DERIVATIVE OPERATOR

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Abstract

This paper presents the approximate analytical solutions to solve the nonlinear homogeneous and non-homogeneous gas dynamics equations with Atangana-Baleanue fractional derivative operator. The validity of the solutions is verified by providing the existence and uniqueness criteria of solution for used technique. To illustrate the ability and efficiency of the method, absolute error, tables and graphical presentations of numerical solution for specific cases are obtained.

Keywords: Atangana-Baleanue operator; Fractional gas Dynamic equations; Iterative Laplace transform method.

RODRIGUE'S FORMULA FOR THE HYPERGEOMETRIC POLYNOMIAL SET $R_N(X_1, X_2, X_3)$

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Abstract

In the present paper, The Hypergeometric Polynomial Set $R_n(x_1, x_2, x_3)$ has been expressed in terms of n^{th} derivatives of certain Lauricella function of the superior orders, which called a Rodrigues formula. Many interesting new results may be obtained as particular cases on specializing the parameters. Out of these particular results some of them stand for well-known polynomial and some of them are believed to be new.

Keywords: Rodrigue's formula, Hypergeometric function, Lauricella functions.

MONOTONE METHOD FOR FINITE SYSTEM OF FRACTIONAL REACTION DIFFUSION EQUATION AND APPLICATIONS

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Abstract

In this paper, we investigate the existence and uniqueness of solution of initial and boundary value problems for fractional diffusion equations with initial and boundary condition involving the finite system of Riemann-Liouville fractional diffusion equations of the form:

$$\frac{\partial \Psi_i}{\partial t^q} - k_i \frac{\partial^2 \Psi_i}{\partial x^2} = f_i(x, t, \Psi_1, \Psi_2, \dots, \Psi_N) \; On \; \Delta_T .$$

$$\Psi_i(0, t) = A_i(t), \; \Psi_i(L, t) = B_i(t) \; in \; \xi_T.$$

$$\Gamma(q) t^{1-q} \Psi_i(x, t)\Big|_{t=0} = f_i^0(x) \; x \; in \; J,$$

$$where \; i = 1, 2, \dots, N, f_i \in \mathbf{C[[0, L] \times [0, T] \times R^n, R]}, J = \mathbf{[0, L]}, I = \mathbf{(0, T]},$$

$\Delta_T = I \times J, k > 0$ *and* $\xi_T = (0, T) \times \partial J$. To develop monotone method for non-linear finite system of Riemann-Liouville reaction-diffusion equations. The monotone method yield monotone sequences which converges uniformly and monotonically to coupled minimal and maximal solutions.

Keywords: Riemann-Liouville fractional derivative, coupled upper and lower solutions, mixed quasimonotone functions.

BIANCHI TYPE-I UNIVERSE IN PRESENCE OF PERFECT FLUID WITH NUMERICAL SOLUTION

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Abstract

In this paper, Einstein's field equation in the presence of perfect fluid for Bianchi Type-I universe is considered such that the cosmological term is proportional to log R . Various numerical solution to field equations is discussed. The physical significance of the cosmological models is also discussed.

Keywords: Bianchi Type-I universe, Perfect fluid, Variable G, Cosmological model. Numerical solution

HIGHER DIMENSIONAL BIANCHI TYPE –III VISCOUS FLUID STRING COSMOLOGICAL MODEL

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Abstract

This article is concerned with the cosmological model in the framework of Sen-Dunn theory of gravitation. We have considered this model in the higher dimensional Bianchi type- III having viscous fluid string as matter. We consider two different scale factors, for getting deterministic solution in which are positive constant. This gives a deceleration parameter which is time dependent. Physical properties of each model are evaluated and the dynamical behaviour of the cosmological parameters is also discussed through the representation of graphs. It is noticed that these models aptly describe the accelerated expansion of the cosmos.

Keywords: Cosmic string, Bulk viscosity, Bianchi type-III, Sen-Dunn Theory

MATHEMATICAL ASPECTS OF INDIAN CLASSICAL MUSIC

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Abstract

Music is an art. Mathematics can be in any art. The sound and beat of music are filled with mathematical numbers in the form of frequency. One can find interest and art in mathematics, music taught by a good master or master has both taste and art, as well as mathematics of good proportion, to enhance artistry. Primarily sound is the soul of music, which is related with physics; It is only science in music thinking, physics is completely based on mathematics, the results obtained by mathematics to recognize the inner soul of music are very important instrument material for any student or artist. When contemplation is done on any subject, many mysteries and facts related to that subject are revealed by themselves. By thinking on this subject, many musical and vocal thoughts and facts related to the subject of mathematics are presented in the research paper. An attempt is made to bring such vision through this research paper.

Keywords: mathematics, Indian classical music, swar, rag.

MATHEMATICAL MODELING OR AND ELEMENTARY FUNCTIONS

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Abstract

A model is a representation of a realistic situation for easy understanding and analysis of the problem under study. The word model has seven spheres of meaning for instance a model may act as a substitute for representing reality. The prime criterion of OR approach any problem is model building several types of models can be used for the OR study. Basically all these models can be categorized.1. Physical models, 2. Analogue Models, 3.Mathematical Models: These models are also known as symbolic model. These models represent the system through mathematical language. The various inner relationships among the variables, constant and parameters. The exponential function exp, of a complex variable z is defined by exp z=ex (cos y +i sin y), where z= x+iy. Note that ex exp x cos y and sin y are usual exponential and trigonometric functions. I have often use the notation ez for exp for the name of the function and ez it is the value.

Keywords: Introduction, History of OR, Identification of the problem, Phases of OR, Construction a Mathematical Model, OVERVIEW OF OR, Game theory, Model in OR, Descriptive models, Explanatory models, Prediactive models, perspective models, Mathematical modelling.

NUMERICAL SOLUTION OF BLOOD FLOW BY K-L MODEL THROUGH MULTIPLESTENOSESINNARROWARTERY

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Abstract

A mathematical model designed here for the study about the effects of blood flow parameters in narrow arteries having multiple stenoses. In this work, blood is considered as a non-Newtonian Kuang-Luo (K-L) fluid model, with no-slip conditions at the arterial wall. In fact the main properties of K-L fluid model, is that the plasma viscosity and yield stress play a very important role. These parameters make this fluid remarkably similar to blood, however when we change these parameters the flow characteristics change significantly. We have derived numerical expression for the blood flow characteristics such as resistance to blood flow, blood flow rate, axial velocity, and skin friction. These numerical expressions have been solved by MATLAB 2021 software and discussed graphically. Furthermore, these results have been compared with Newtonian fluid and observation made that resistance to blood flow and skin friction is decreased when blood is changed from non-Newtonian to Newtonian fluid.

Keywords: Stenosis, resistance to blood flow, blood flow rate, skin friction, K-Lfluid model.

STUDY OF PERIODIC COSMIC EVOLUTION IN MODIFIED F(Q,T)GRAVITY THEORY

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Abstract

A completely promising theory of gravitation urges us to go beyond the general theory of relativity. One such approach is an extended class of symmetric teleparallel theory of gravity, namely f(Q,T) gravity. In this work, we have explored the cosmological background of the flat FLRW universe within the framework of this theory. The cosmic transit phenomenon of the deceleration parameter is studied by employing periodic varying deceleration parameter and accordingly obtained the exact solution of the highly non-linear field equations. The periodic scenario of cosmological models with two different Lagrangian forms of f(Q,T) are analyzed, where the first form is the linear and second one is non-linear dependent on Q. The dynamical features of both the models including the periodic behaviour of the equation of state parameter are discussed. The self-stability and self-consistency of the derived models are tested by studying energy conditions. Additionally, geometrical diagnostic validation of the model is also checked.

Keywords:f(Q,T) gravity theory; FLRW space-time; Periodic Deceleration Parameter; Energy conditions and Geometric Diagnostics.

DYNAMICS OF BIANCHI TYPE-VI_0 UNIVERSE IN GENERAL AND MODIFIED THEORIES OF GRAVITATION

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Abstract

In this article, we have considered Bianchi type-VI_0 metric and analyzed various dynamical properties for different theories of gravitation with Hydrodynamic source. This paper mainly consists of two parts: In first part cosmological model is studied in General Theory of Relativity while in second part it is scrutinized in f(R) gravity with same source. In Part I, we observed that Relativistic Hydrodynamic cosmological model is unstable and the model is completely immersed with dark energy Quintessence fluid. While in Part II, we found that Relativistic Hydrodynamic cosmological model is stable and the model is initially occupied Phantom dark energy fluid and with the increase in time it is immersed by Quintessence fluid. Besides this, few kinematical and physical properties are too examined for each of the two theories of gravitation.

Keywords: Hydrodynamics, Bianchi type, f(R) gravity, General theory of relativity, Cosmology, Stability parameter, state finder parameter.

THE RECURRENCE RELATIONS FOR THE CLASSICAL POLYNOMIAL SET $D_N\{(X_K),Y\}$

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Abstract

In the present paper, an attempt has been made to express the Recurrence Relations for the classical polynomial set $\mathbf{D_n}\{(x_k), y\}$ has been defined by means of generating relations which contains the product of Generalized Hypergeometric functions and Lauricella function in the notation of Burchnall and Chaundy [1]. This polynomial set covers as many as thirty nine orthogonal and non-orthogonal polynomials and have been obtained with three special cases. Many interesting new results may be obtained as particular cases on separating the parameters.

Keywords : Hypergeometric function, Lauricella function, orthogonal polynomial, non-orthogonal polynomials, Legender Polynomial.

BIANCHI TYPE - II COSMOLOGICAL MODEL WITH VARYING COSMOLOGICAL TERM

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Abstract

In this paper, we attempt to study a new class of totally anisotropic Bianchi type-II cosmological model with perfect fluid distribution in presence of time varying cosmological and gravitational constant in the framework of general relativity. Exact solutions of Einstein's field equations are obtained by assuming that the cosmological term is proportional to the square of the Hubble parameter. We have also discussed different types of physical and kinematical behavior of the model.

STUDY OF BIANCHI TYPE – VI DOMAIN WALLS COSMOLOGY IN SAEZ-BALLESTER THEORY OF GRAVITATION

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Abstract

In this paper, we have presented the Bianchi Type – VI cosmological model in the presence of domain walls in the context of the scalar-tensor theory of gravitation proposed by Saez and Ballester. It is found that the cosmological model obtained is the inflationary type and free from initial singularity. Also, some physical and kinematical properties have been discussed.

KALUZA-KLEIN UNIVERSE INTERACTING WITH WET DARK FLUID IN GENERAL RELATIVITY

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Abstract

In this paper, we have considered five-dimensional Kaluza-Klein space-time in the presence of wet dark fluid in the framework of the general theory of relativity. The solutions have been obtained in the quadrature form. The cosmological model with constant deceleration parameter is also discussed in detail.

DARK ENERGY COSMOLOGICAL MODELS FOR BIANCHI TYPE-I SPACE-TIME WITH CONSTANT DECELERATION PARAMETER IN LYRA GEOMETRY

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Abstract

The main purpose of this manuscript is to investigate the Bianchi type-I dark energy cosmological models in the framework of Lyra geometry. The modified Einstein's field equations are derived for Lyra geometry and obtained the exact solutions. To obtain the exact solutions volumetric expansion law is used. As per the Exponential and Power-law expansion, we have discussed the two cosmological models. Several physical parameters are obtained for both the models and discuss their physical importance following the observational data.

Keywords: Bianchi type-I, Cosmological constant, Lyra geometry

SOME STUDY OF BLACK HOLE THROUGH GRAVITATIONAL - LENSING

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Abstract

In this paper we want to analyze the behavior and pattern of Black Hole through Gravitational lensing. It is the study of the bending of light by gravity. In such a scenario, light rays comes from a background star are deflected as they pass by a galaxy (the "lens"). Light rays passing very close to a black hole may experience very strong deviations. Two geometries have been separately considered in recent literature: a source behind the black hole (standard gravitational lensing) and a Source in front of the black hole (retro lensing).The mathematical theory of gravitational lensing have revealed many generic and global properties. Beginning with multiple imaging, we review Microlensing, spherically symmetry of black hole, Schwarzschild black hole etc.

Keywords: - Gravitational lensing, Black Hole, Microlensing, Schwarzschild.

(2 + 1)-DIMENSIONAL BIANCHI TYPE I UNIVERSE WITH WET DARK FLUID IN GENERAL THEORY OF RELATIVITY

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Abstract

In this paper, we have investigated (2+1)-dimensional cosmological models for Bianchi Type-I space-time in presence of wet dark fluid in the framework of the General Theory of Relativity. The solutions have been obtained are in the quadrature form. Also, the models with constant deceleration parameter have been discussed in detail.

AN ESTIMATOR OF POPULATION MEAN USING AUXILIARY INFORMATION FOR SMALL SAMPLES

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Abstract

In this paper a new class of estimators for estimating population mean under general sampling design has been proposed. The expressions of bias and mean square error of the suggested estimator are derived. For the optimum choice of constants, it is more efficient than other existing estimators. Further properties of the proposed estimator are discussed under simple random sampling without replacement procedure. Numerical illustrations have been made.

Keywords: Auxiliary Information; Bias; Mean Squared Error (MSE); Relative Efficiency; Simple Random Sampling without Replacement (SRSWOR); Order of Approximation.

A NOTE ON THE ESTIMATION OF VARIANCE OF SAR (1) AND SMA (1) MODELS IN THE PRESENCE OF SEASONAL LEVEL SHIFT OUTLIER

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Abstract

Time series observations are subject to outliers which hamper the identification, estimation, and forecasting in time series analysis. There are different types of outliers classified in time series depending on their patterns and the seasonal level shift (SLS) outlier is one among them. The seasonal level shift outlier occurs mainly in seasonal time series. It is well known that outliers affect the time series observations and also the residual series. An integral part of time series analysis is the estimation of variance, for which the residual series are used. The present work deals with studying the effect of SLS outlier in the estimation of variance of the Seasonal Autoregressive model of order one (SAR (1)) and Seasonal Moving Average model of order one (SMA (1)). The results are algebraically obtained and simulation studies are carried out. It was found that the parameter of the underlying model, sample size, and magnitude of the outlier affects the estimated variance when the series is perturbed by an SLS outlier.

Keywords: Time series, Seasonal Level Shift, Residuals, Variance, Seasonal Autoregressive, Seasonal Moving Average.

LRS BIANCHI TYPE-I MAGNETIZED COSMOLOGICAL MODEL IN BIMETRIC THEORY OF RELATIVITY

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Abstract

In this paper, we examine LRS Bianchi Type-I model with for cloud of string in presence of magnetic field by solving Rosen's field equations. The paper explores the geometrical and physical properties of the model in (i) power law and in (ii) exponential law both. The pressure, string tension density, particle density in each model is decreasing with time. We found that expansion with steady speed in power law model while in exponential model, our universe has accelerating contraction. The other geometrical and physical properties are also discussed.

Keywords: Bimetric Gravitation, Dark Energy, Dark Matter

PREDICTION OF UNWANTED PREGNANCY IN INDIA: A MACHINE LEARNING APPROACH

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Abstract

Almost half of India's 48.1 million pregnancies were unintended (Lancet Global Health, 2018). This paper explores unwanted pregnancy prediction, based on various statistical & machine learning models and uses under-sampling, to improve the predictive power of utilized models, considering the imbalance characteristics of unwanted pregnancy rate in the data. We have proposed a weighted variable to eliminate the effect of under-sampling. The model comparisons show that out of the various machine learning models, Random Forest, which predicts the unwanted pregnancy with 80.35% accuracy, is the most powerful model for the scenario. The model outputs suggest that unmet need for contraception, knowledge of contraception methods, age at first birth, wealth status, total children ever born, knowledge of ovulation cycle, place of residence, woman's education, woman's age, and marital duration are the strongest predictors to estimate the unwanted pregnancy. The model can be deployed by the policymakers in the sub-regions of India in the future to predict the prevalence of unwanted pregnancy and run a customized campaign to reduce the events of unintended pregnancy through various medical and social interventions.

Keywords: Unwanted Pregnancy; Prediction; Classification Techniques; Machine Learning; Artificial Neural Networks; Random Forests.

OPTIMAL CONTROL SOLUTION FOR THE TREATMENT OF NATURAL KILLER CELLS ALONG WITH CD8+ T CELLS IN TUMOR GROWTH

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Abstract

The optimal control system and interaction between growing tumor cells and host immune system help to understand the dynamics of tumor growth cells. This system has various important method of cancer therapy such as virotherapy, immunotherapy, chemotherapy, radiotherapy, drug and vaccine therapy and many others scientific solutions to analyze the dynamics of cancer cell. This mathematical model involving ordinary differential equation system to interact between the growing tumor cells and cell in the immune system including natural killer cells, dendritic cells, and cytotoxic CD8+ T cells combined with drug and vaccine intervention to these cells. This model of a control function, representing the application of natural killer cell combined with CD8+ T cell treatment to the system. The numerical solutions thus obtained from Runge-Kotta 4th ordered method. Further the impact of additional CD8+ T cell regulation parameter with natural killer cell help to reduce the proliferation rate of tumor growth cell also observe. This result will help to develop control mechanism and to provide the dynamic interactions between the tumor cells, immune system, and drug response systems.

Keywords: Optimal Control; Tumor growth; cytotoxic CD8+ T cell; diffusion; Runge-Kutta method.

WEAK LEADER-TYPE CONTRACTIONS IN QUASI-TRIANGULAR SPACES

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Abstract

Let $C = \{C_\alpha\}_{\alpha \in A} \in [1; \infty)^A$ with index set A. A quasi-triangular space $(X, P_C; A)$ is a set X with family $\{P - C.; A = \{p_\alpha\}: X^2 \to [0, \infty), \alpha \in A$ satisfying $(\forall_{\alpha \in A} \forall_{u,v,w \in X} (p_\alpha(u,w) \leq C_\alpha [p_\alpha(u,v) + p_\alpha(v,w)])$. In $(X, P_C; A)$, using the left (right) families $(J_C; A)$generated by $(P_C; A)$ is a particular case of $(P_C; A)$)-convergence, existence, periodic point, fixed point, and (when$(X, P_C; A)$is separable) uniqueness for $(J_C; A)$-contractions and weak $(J_C; A)$-contractions $(T: X \to X$) satisfying

$$\forall_1(x, y \in X) \forall_1(\alpha \in A) \forall_1(\varepsilon > 0) \exists_1(\eta > 0) \exists_1(r \in N) \forall_1(s, l \in N) \{J_\alpha(T^{[s]}(x), T^{[s+r]}(x)) \mid J_\alpha(T^{[l]}(y), T^{[l+r]}(y)) < \eta + \varepsilon$$

$$\Rightarrow C_\alpha J_\alpha \left((T^{[s+r]}(x), T^{[l+r]}(y)\right) < \varepsilon\}$$

And

$$\exists_{w^0 \in X} \forall_{\alpha \in A} \forall_{\varepsilon > 0} \exists_{\eta > 0} \exists_{r \in N} \forall_{s,l \in N} \{J_\alpha(T^{[s+r]}(w^0), T^{[s]}(w^0)) + J_\alpha(T^{[s]}(w^0), T^{[l+r]}(w^0)) < \eta + \varepsilon \Rightarrow C_\alpha J_\alpha(T^{[s+r]}(w^0), T^{[l+r]}(w^0)) < \varepsilon\}$$

respectively. The spaces $(X, P_C; A)$, in particular, generalize metric, ultrametric, quasi-metric, ultra-quasi-metric, b-metric, partial metric, partial b-metric, pseudometric, quasi-pseudometric, ultra-quasi-pseudometric, partial quasi-pseudometric, topological, uniform, quasi-uniform, gauge, ultra gauge, partial gauge, quasi-gauge, ultra-quasi-gauge, and partial quasi-gauge spaces. Results are new in all these spaces. Examples are provided.

Keywords. Quasi-triangular space, Leader-type contraction convergence, periodic point fixed point uniqueness.

ON THEORY OF AN OPTIMAL DRAWING

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Abstract

In this paper, we have develop theory of an optimal drawing on a manifolds

Keywords -Graph Invariant, Optimal Drawing, Optimal drawing Invariant, Optimal Drawing colouring.

MONOTONE METHOD FOR FINITE SYSTEM OF FRACTIONAL DIFFERENTIAL EQUATIONS WITH INITIAL TIME DIFFERENCE

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Abstract

Qualitative results such as existence and uniqueness of finite system of Riemann-Liouville (R-L) fractional differential equations with initial time difference are obtained. Monotone technique coupled with method of lower and upper solutions is developed to obtain existence and uniqueness of solutions of finite system of R-L fractional differential equations with initial time difference.

Keywords: Initial Time Difference, Monotone Method, Existence and uniqueness, Fractional Differential Equations, Lower and Upper Solutions.

ANTI- PHOTON, Z_Q MESON AND QUONIC NUMBER N CONSERVATION

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Abstract

It is suggested that a spin one particle decays in 84 atta seconds, involving anti-photon, a gamma, quon and a neutrino of quon. I postulate that quon transforms as $Z_q$meson and an anti neutrino. Z_q has zero charge, mass of about 91.2 GeV/c^2. The quon negative and quon positive decays are outlined. The neutrino, electron and quon negative have, lepton as plus one, while anti-neutrino, positron and quon positive have, lepton as minus one. S- Matrix with charge conjugation operator is formulated, with the quonic number n conservation. The anti- lepton negative associated with a "Star" in the incoherent scattering is found significant, with R as a target nucleus.

Key words: Anti- Photon, Z_qMeson, Anti – Neutrino, Star.

THE ONSET OF CONVECTIVE MOTIONS IN COMPLETELY CONFINED FLUIDS

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Abstract

One of the important aspects of the stability theory of any fluid flow is to investigate the nature of the onset of instability when the initial flow becomes unstable. The onset of instability may manifest through oscillations or stationary modes, i.e. when the time-dependent oscillating disturbances are damped, the principle of exchange of stability is said to be valid, and when these disturbances grow the over stability occurs. Mathematically, when PES is valid, the motions are stationary and consequently, the unsteady terms are eliminated from the linearized eigenvalue problem. The principle of exchange of stabilities (PES) for the thermal stability problem has been proved by Pellew & Southwell (1940) for fluids bounded by two infinite, horizontal parallel planes. Chandrasekhar (1952) discussed in detail the establishment of PES for the same geometry when the fluid is an electrical conductor and when an arbitrary oriented, uniform external magnetic field is applied in the vertical direction. In the domain of linear stability theory, the convection problems can be described by a set of linear ordinary differential equations with constant coefficients and homogeneous boundary conditions (Yih (1959)). The task of finding explicit analytical solutions of these equations (especially when the boundaries are rigid) and thus characterizing the onset of instability is not entirely trivial, since a prohibitive amount of numerical computation is required to affirm oscillatory or non-oscillatory motions as the eigenvalue equation involves all the parameters of the problem implicitly. Most of the papers that are written on the subject of linear stability theory are confined to horizontal layer geometry on account of the complexity of the problem for arbitrary geometry. However, there does exist a class of results in the domain of linear hydrodynamic and hydromagnetic stability theory that could be generalized, as shown by Sherman and Ostrach (1966), for the magnetohydrodynamic thermal stability problem in completely confined fluids. Recently, Gupta and Dhiman (2001), and Gupta et. al (2002) have studied the magnetohydrodynamic thermal/thermohaline stability

problems in completely confined fluids and have derived a bound for the linear complex growth rate of an arbitrary oscillatory perturbation, which may be neutral or unstable. In this presentation, the stability analysis of more general problems, namely, thermohaline stability problems of Veronis and Stern type configurations for fluids completely confined in an arbitrary region bounded by rigid walls and permeated by a magnetic field applied in an arbitrary direction will be discussed, using 'definite integral' method of Davis (1969). Some qualitative mathematical results concerning the character of the marginal state, stability of oscillatory motions, and limitations on the oscillatory motions of growing amplitude will be presented.

Keywords: Thermal instability; the principle of exchange of stability; linear stability theory; horizontal layer geometry; completely confined fluids; definite integral method; thermohaline stability problems.

EXACT SOLUTIONS OF NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

Utt - Uxx = U2N+1, WHERE n IS ANY NONZERO REAL RATIONAL NUMBER

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Abstract

Using Lie Group Similarity Transformation, the nonlinear partial differential equation utt − uxx =u2n+1 where n is any real rational number of the form $\boldsymbol{\frac{p}{q}}$, where p and q are any positive or negative integer numbers, except n = 0 and n =−**14**, reduced to second order nonlinear ordinary differential equation and exactly solved. Each and every solution is a combination of a pair of exact solutions and both exist independently and they form a new class of solutions of Klein-Gordon family of nonlinear partial differential equations

Keywords: Solutions, Nonlinear, Partial Differential Equations, Real, Rational number, Nonzero

NUMERICAL STUDY OF FIVE-DIMENSIONAL COSMOLOGICAL MODEL IN PRESENCE OF PERFECT FLUID WITH VARIABLE \MATHBIT{G}

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Abstract

In this paper, we have studied five dimensional cosmological model in the presence of perfect fluid with variable G and \mathrm{\Lambda}. For our study we have used Kaluza-Klein space time. P.A.M Dirac say that G is proportional to t^{-1}. In this paper, we have done numerical study of the various cases of field equation and found that universe is accelerating.

Keywords: Five dimensional, Kaluza-Klein theory. Perfect fluid, Variable G, Cosmological constant.

RECENT ADVANCES IN GRAPH THEORY AND IT'S APPLICATIONS

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Abstract

The field of mathematics plays vital role in various fields. One of the important areas in mathematics is graph theory which is used in structural models. This structural arrangement of various objects or technologies lead to new inventions and modifications in the existing environment for enhancement in those fields. This paper describe the description of graph theory.

Keywords: Graphs, connectivity, constraints, graph coloring, graph drawing

ANALYSIS AND APPROXIMATION THEORY IN NUMERICAL ANALYSIS

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Abstract

In order to estimate the 1D nonlinear hyperbolic Sine-Gordon equation, the Crank-Nicolson differential quadrature method based on cubic exponential B-spline (CExpB-spline) functions is provided (SGE). The typical forward difference scheme is utilized to discretize the temporal derivative, and the differential quadrature method (DQM) is employed to integrate the spatial derivatives. Systems of linear equations result from the problem's discretization. In order to examine the effectiveness and precision of the procedure, three numerical examples are used. It has been noted that the proposed method outperforms the current methods in terms of results. The proposed method's rate of convergence (ROC) is calculated numerically, demonstrating its second-order spatial accuracy. We examine the main contributions made by the Indian School of Numerical Analysis and Approximation Theory of ClujNapoca to the Approximation Theory of the Functions from a historical perspective.

Keywords: Functions, Non-linear, Linear, Equation, historical

UNDER THE HUBBLE'S CUTOFF PHYSICAL ACCEPTABILITY OF THE RENYI HOLOGRAPHIC DARK ENERGY MODEL IN F(T,B) GRAVITY

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Abstract

In this paper, we have studied accelerating cosmological models in Modified theory of gravitation. We have considered the f (T, B) Gravity in which the physical acceptability of the Renyi Holographic Dark Energy in the presence of Under the Hubble's Cutoff consider.

Keywords: f\left(T,B\right) gravity, Renyi, Hubble's Cutoff, accelerating cosmological models, Modified theory of gravitation

A STUDY OF THE RAYLEIGH WAVE FIELD IN AN UNBOUNDED MEDIUM WITH INTERIOR INITIAL CONDITIONS

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Abstract

This article investigates the Rayleigh wave field in terms of initial displacement and velocity pattern on the surface of an elastic non-homogeneous half-space due to an interior initial displacement. The stress field of the Rayleigh wave is calculated in an unbounded space due to the interior initial conditions. As a result, discrepancies occur at the free surface of the isotropic half-space. In order to calculate the Rayleigh wave contribution analytically, integral transformation techniques are implemented to obtain the solutions to the equations of motion. A sinusoidal variation along a horizontal interior line of the initial vertical velocity is illustrated.

Keywords: Rayleigh wave, Interior initial condition, Integral transformation, Bessel functions, half-space.

LRS BIANCHI TYPE-I COSMOLOGICAL MODEL WITH POLYTROPIC EQUATION OF STATE IN $f(R,T)$ THEORY OF GRAVITATION

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Abstract:

The LRS Bianchi Type-I cosmological model with variable cosmological parameter Λ has been studied in $f(R,T)$ theory of gravitation, where R is Ricci scalar and T is trace of the stress energy momentum tensor. The general solution has been obtained by assuming the form of function $f(R,T)$ as $f(R,T)=f_1(R)+f_2(T)$ andwith polytropic equation of state. The cosmological dynamical parameters of the model are also discussed.

Keywords: LRS Bianchi Type-I, $f(R,T)$ Theory of Gravitation, Polytropic equation of state.

STOCK MOVEMENT OF SUN PHARMACEUTICAL INDUSTRY LIMITED POST COVID-19 – TECHNICAL ANALYSIS

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Abstract:

Stock Market serves as one of the primary indicators to measure the economic stability of a nation. Though COVID-19 pandemic collapsed the global economy, pharma sector managed to survive that tough phase. From there on, the pharma sector is steadily moving ahead in the bullish trend. There are many technical indicators to forecast the price movement of the stock. In this paper, we chose two particular indicators—the Bollinger Band and Awesome oscillator—to forecast Sun Pharmaceutical Industry Ltd. in the pharma sector. The historical data between 1st April 2021 and 30th September 2022 has been used for our analysis. This study intends to analyze the movement of pharma sector in the Indian stock market post COVID-19. Sun Pharma being one of the sector leaders, it has been considered for our study.

Keywords: Stock analysis, technical analysis, forecast, Sun Pharma, pharma sector, Bollinger Band and Awesome Oscillator.

FITTING HETEROGENEOUS LANCHESTER MODELS ON THE KURSK CAMPAIGN OF THE SECOND WORLD WAR

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Abstract

The battle of Kursk between Soviet and German is known to be the biggest tank battle in the history. The present paper uses the tank and artillery data from the Kursk database for fitting both forms of homogeneous and heterogeneous Lanchester model. Under homogeneous form the Soviet's (or German's) tank casualty is attributed to only the German's (or Soviet's) tank engagement. For heterogeneous form the tank casualty is attributed to both tank and artillery engagements. A set of differential equations using both forms have been developed, and the commonly used least square estimation is compared with maximum likelihood estimation for attrition rates and exponent coefficients. For validating the models, different goodness-of-fit measures like R^2, sum-of-square-residuals (SSR), root-mean-square error (RMSE), Kolmogorov-Smirnov (KS) and Chi-square (χ^2) statistics are used for comparison. Numerical results suggest the model is statistically more accurate when each day of the battle is considered as a mini-battle. The distribution patterns of the SSR and likelihood values with varying parameters are represented using contour plots and 3D surfaces.

Keywords: Battle of Kursk, Homogeneous & Heterogeneous Lanchester Model, Goodness-of-fit, Kolmogorov-Smirnov, Sum-of-square residuals, Chi-square.

ESTIMATING RESPONSE OF DEVELOPMENTAL PROGRAMS USING RANKED SET SAMPLING

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Abstract

Assessing the developmental programs (say, women empowerment programs for enhancing gross enrolment ratio) implemented in different phases is a challenge. The linear and non-linear impacts of the programs under successive phases and multiplicative model which relates the response and survey variables is considered for mean estimation of response variable. The ranked set sampling (RSS) procedure on survey variable is used. The proposed estimator is compared with the estimator based on SRS in terms of relative precision (RP). The gains in RP of RSS based estimators are substantial for all sample sizes and chosen distributions. Real life examples are also presented.

Keywords: Developmental program; impact evaluation; order statistics; relative precision; skewed distribution; symmetric distribution.

CONSTRUCTION AND ANALYSIS OF LATIN SQUARES FOR THE ORDER (P X P) & (PM X PM) BY USING GALOIS FIELD THROUGH THE 'R' PROGRAM

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Abstract

This article mainly focuses on the construction standard Latin square design problems using existing methods such as the Galois field and permutation methods using the R coding approach. Using the Galois field method, we can quickly identify the number of standard Latin square designs, but it is not easy to manually describe every standard Latin square. We have proposed some programming solutions to resolve such kinds of problems. These techniques help the survey practitioners identify the structure of the standard Latin square for dealing with real problems.

Keywords: Design of Experiment, Latin Squares, Galois Field, R Program

DEVELOPMENT OF LENGTH BIASED POWER AKASH DISTRIBUTION AND ESTIMATION OF ITS PARAMETERS

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Abstract

In this paper, a new distribution namely the length biased power Akash distribution is proposed. The different mathematical and statistical properties of the proposed distribution are derived and discussed. The proposed distribution possesses upside down bathtub shape of hazard rate. The parameters of the proposed distribution are estimated by using the method of maximum likelihood estimation. The performance of the newly developed distribution is studied using real- life data sets.

Keywords: Power Akash Distribution, Reliability Measures, Upside down bathtub shape hazard rate, Moments, Moment Generating Function, Order Statistics, Entropy, Maximum Likelihood Estimation.

A SUPER POPULATION MODEL APPROACH TO IMPUTATION FOR ESTIMATING POPULATION MEAN

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Abstract

In this paper a Super population Model-based study of some imputation strategies have been done for estimating population mean under non - response, considering population is of dynamic nature which is a more practical and relevant approach. Bias's and MSE's have been obtained under model-based approach; also, empirical comparisons of the strategies have been done with a number of PRMs for different non-response rates so as to observe their performance over varying non-response rates. Robustness of the estimators have also been considered under misspecification of model.

Keywords: Super population, Polynomial regression model, Imputation, misspecification of models.

A QUADRATIC TYPE ESTIMATOR OF POPULATION MEAN ON TWO OCCASIONS

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Abstract

The paper deals with an estimator of population mean on current occasion based on samples selected over current and previous occasions if a quadratic relationship between study and auxiliary variables exists. Properties of proposed estimator has been discussed and it is ascertained that it is more efficient than usual estimators for optimal choice of constants included in the estimator. An optimum replacement policy of proposed estimator has been studied. Numerical illustrations have been cited in support of the theoretical results.

GREEN GRAM PRICE FORECASTING USING TIME SERIES MODELS IN ANDHRA PRADESH

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Abstract

Green gram scientifically known as Vignaradiata is a plant species in the legume family and commonly called as mung bean, moong in India. India is its primary origin and is mainly cultivated in East Asia, Souteast Asia and the Indian subcontinent. It is the third important pulse crop of India grown in nearly 16 per cent of the total pulse area of the country. The study was intended to check and identified the trend analysis and best forecasting model of Green gram prices in Andhra Pradesh. The data were obtained from Directorate of Economics and Statistics, Andhra Pradesh. Data was analysed by using SPSS 20.V software the findings of the study are based on different non-linear models of Green gram prices. The prices of Green gram data considered during the year 1991-2022. Non-linear models and trend analysis were applied; present study was exponential model appropriate for Green gram prices. The R-square and Maximum Absolute Percentage Error (MAPE) value was 0.88 and 16.58 respectively

Keywords: Green gram, Time Series model, MAPE, and Prediction

FACTORS AFFECTING THE PRICES AND FORECASTING MODEL FOR PREDICTION OF THE PRICES OF GOLD IN INDIA

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Abstract

In this paper, an attempt has been made to study the factors affecting prices of gold and to propose a forecasting model for predicting the price of gold in India. The various factors affecting the gold prices in the Indian economy have been identified. Then, multiple regression model and Coefficient of Determination was used for understanding the effect of different factors like Exchange rate, Inflation rate, Crude oil, Interest rate, etc on the prices of gold. The data was transformed using ADF test the stationarity was tested. The lag values was conducted by ACF and PACF plots. Taking the possible neighbouring values from resulting model and using mean absolute percentage error (MAPE), Bayesian Information Criterion (BIC), Mean Absolute error (MAE) and the value of R^2 as the forecasting accuracy measure. And finally it was found that ARIMA model was the most suitable for predicting the gold prices.

BAYES ESTIMATORS FOR THE PARAMETERS OF BINOMIAL TYPE RAYLEIGH CLASS SOFTWARE RELIABILITY MODEL USING NON-INFORMATIVE AND INVERTED GAMMA PRIOR

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Abstract

The reliability of software can be assessed by the failure occurrence behavior while software testing. Here, the Rayleigh Class software reliability growth model is proposed by assuming the Binomial pattern of failure occurrence. The behavior of number of inherent faults present in the software and the scale parameter of Rayleigh Class Model has been studied. Also, Bayes estimates for number of inherent faults and scale parameter are proposed using the Non-informative, Inverted Gamma Priors respectively. The performance of Proposed Bayes estimators is compared with corresponding MLE's on the basis of Relative efficiencies obtained by Monte Carlo Simulation technique.

Keywords: Software Reliability Growth Model, Binomial Type, Failure Intensity, Mean Failure Function, Rayleigh Class, Non-informative Prior, Inverted Gamma Prior, Risk efficiency.

TIMBER ESTIMATION USING EULER GRAPH AND SAMPLING WITH IMPUTATION FOR ECONOMIC PREDICTION OF FOREST

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Abstract

Forest contains resources of many products having strong impact on the economy of a tribal Region. Several countries in the world are rich in forest area and roads of many cities pass through the forest. The wood (timber), fruits, leaves and medicinal plants are the major products of forest. A person may be interested to know the average amount of forest products likely to be available between any two cities in forest catchment area. This paper is focused on the average wood resource (timber) estimation between any consecutive pair of cities. An Euler graph is used as a model to meet the real situation. Euler imputation is helpful to resolve the difficulty raised in estimation. As a model tool an imputed Euler graph is suggested in the form of imputing edge matrices to equalize the degrees of all vertices of the Euler graph. Confidence intervals of sample estimates are calculated. An Euler simulation method is suggested, for comparison purpose. Two estimation methodologies such as forward-edge-approach and backward-edge-approach among connecting vertices are used and compared in terms of minimum estimated average length of confidence intervals using Euler simulation.

It was found that an imputed Euler graph model structure is helpful to estimate the average amount of timber in the forest between any pair of consecutive cities within the forest catchment area. The backward-edge approach is better than the forward-edge-approach. Results are numerically verified over the dataset of edges of an imputed Euler graph. Such estimates could be utilized in the forest audit or in the wood energy audit demanded by the government agencies. Estimates of forest products have intense impact upon the upliftment of the regional economy and social development.

SOME FIXED POINT THEOREMS FOR SET VALUED FUNCTIONS IN PARTIALLY ORDERED METRIC SPACES

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Abstract.

In this paper we have considered the partial ordered set (X, ≤) and there exists a complete metric d on X. Let us denote CB(X) to be a set of all closed and bounded subsets of X and there we have Hausdorff metric H on CB(X) induced by metric d. With the help of nonlinear contraction mapping, we extend the result of Srivastava et. Al [1] and proved that the non-decreasing set valued map T: X → CB(X) has a fixed point.

Keywords: Fixed point theory, partially ordered sets, Set-valued mappings

EFFECT OF SEASONAL LEVEL SHIFT OUTLIER ON THE RESIDUALS AND VARIANCE OF SARMA (1, 1) MODEL

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Abstract

The existence of outliers in time series data is very common and its occurrence can be attributed to wars, economic or political changes, etc. Unlike in regression analysis, there are many types of outliers encountered in time series and one such outlier is the Seasonal Level Shift (SLS) outlier. In the present study we explore analytically, the deleterious effect of the presence of SLS on the residuals and variance of Seasonal Autoregressive Moving Average model of order (1,1) (SARMA(1,1)). To gain more insight, we have carried out a simulation study. We have found that the SLS outlier not only affects the residuals at its time of incidence but also at the subsequent seasons in the model. Further, the extent of the effect depends on the parameters(s) of the underlying model. The outlier also affects the variance of the residuals and hence on the variance of the series. The amount of contamination in the variance by the outlier depends on the magnitude of the outlier, sample size, the number of seasons considered and the parameters of the underlying model.

Keywords: Time series, Seasonal Level Shift, Residuals, Variance, Seasonal Autoregressive Moving Average.

MATHEMATICAL MODELING OF LOVE WAVES PROPAGATION IN A COMPOSITE STRUCTURE

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Abstract

A mathematical model is developed to calculate the phase velocity, group velocity of Love waves in a composite structure. The composite structure consists of layer of piezoelectric material/functionally graded porous piezoelectric material (FGPPM) over elastic half-space. The mathematical modeling gives rise to constitutive equations and the analytic solutions of constitutive equations for a functionally graded porous piezoelectric material layer are obtained by using the Wentzel-Kramers-Brillouin (WKB) method. Exponential gradation in mechanical and electrical properties is taken along the thickness direction. Computation of numerical results is carried out and results obtained are validated by obtaining earlier results as a reduced case of this study.
Keywords: Love waves, porous, functionally graded, piezoelectric, phase velocity, group velocity

SH WAVE PROPAGATION IN FUNCTIONALLY GRADED COMPOSITES

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Abstract

Shear horizontal (SH) surface Love waves have long been used in geophysics, seismology, non-destructive testing (NDT) of materials and for determining the physical properties of materials. Shear horizontal surface wave propagation in a composite layered structure, consisting of piezoelectric layers and functionally graded porous piezoelectric material (FGPPM) layer, is studied. The linear and exponential gradation in the material properties of the functionally graded layer is taken along the thickness direction. The analytic solutions of constitutive equations for a functionally graded porous piezoelectric material layer are obtained by using Wentzel-Kramers-Brillouin (WKB) method. Frequency equations are obtained for both types, electrically open and shorted, of boundaries. The effects of the porosity and gradation parameters on the phase and group velocities of Love waves are found. Numerical computation for the phase velocity, group velocity, electromechanical coupling factor and quality factor for different values of layer thickness and porosity is carried out. Validation of the obtained results has been done by obtaining earlier results as a reduced case of this study.

This study is useful in the designing of surface acoustic wave (SAW) devices. Sensors based on Love waves are used for measuring physical properties of the liquid (e.g., viscosity and density) as biosensors and chemo-sensors and also for testing of composites. The use of layered Love waveguides with a nonhomogeneous distribution of physical properties can significantly improve performance (e.g., sensitivity and selectivity) of bio and chemo-sensors that employ the inhomogeneous elastic waveguides.

Keywords: SH wave, piezoelectric material, functionally graded, phase velocity, electromechanical coupling.

PROPAGATION OF LOVE WAVES IN AN ELASTIC MEDIUM OVER A GRAVITATING ANISOTROPIC POROUS HALF SPACE

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Abstract

This problem studies the possibility of propagation of Love waves in an elastic medium over a gravitating anisotropic porous half space. The mathematical analysis of the problem has been dealt with the asymptotic expansion of Whittaker function. The numerical values of the velocity of Love waves have been computed from the equation at different porosity as well as anisotropic factors in half space taking consideration of different rigidity ratios and the density ratios of the layer and half space. The effect of gravity parameter and the porosity parameter on the propagation of Love waves in anisotropic half space remain similar in nature to that as studied in isotropic half space. The dispersion curves show that the presence of gravity field increases the velocity of propagation of Love waves.

Keywords: Love wave, porosity, anisotropic, gravity, Whittaker function.

WEYL TRANSFORM ASSOCIATED WITH LINEAR CANONICAL TRANSFORM

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Abstract

In the present paper, we define the linear canonical wavelets and study the corresponding wavelet transforms along with some useful properties and results for it. Parseval's identity, inversion formula for the linear canonical wavelet transform are obtained. Weyl transform on the admissible linear canonical wavelet space $ \mathfrak{W} $ is introduced and boundedness as well as compactness of Weyl transform in Lebesgue space are discussed.

Keywords: Parseval's identity, linear canonical wavelets, Weyl transform, Lebesgue space

AN IMPROVED RATIO ESTIMATOR OF A FINITE POPULATION MEAN USING TWO AUXILIARY VARIABLES

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Abstract

In this paper we propose a new ratio estimator using two auxiliary variables in simple random sampling without replacement (SRSWOR). We obtain bias and mean square error (MSE) of the proposed estimator and theoretically show that the proposed estimator is more efficient than the Olkin (1958), Des Raj (1965) and Reddy (1974) estimators under a defined conditions. In addition, we support these theoretical result with the aid of a numerical example.

Keywords: Auxiliary variable, Bias, Mean Squared Error (MSE), Simple random sampling without replacement (SRSWOR).

BIANCHI TYPE-I SPACE TIME WITH MATTER BOUNCE COSMOLOGY IN F (R, T) GRAVITY

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Abstract

We presents Bianchi type -I space time $ds^2 = -dt^2 + A^2(t)dx^2 + B^2(t)dy^2 + C^2(t)dz^2$ cosmological modelling of matter bounce in the framework of f(R, T) gravity where f(R, T) = R + 2ΛT. We start by defining a parametrization of cosmic factor a(t) which is non-vanishing. The geometrical parameters such as the Hubble parameter and deceleration parameter are derived and also derived expression of metric function A(t), B(t),C(t) from this investigate hubble parameter with respect to A(t),B(t),C(t) , from which using some condition of integrating constants derived expressions of pressure, density and Equation of State (EoS) parameter and a qualitative understanding of the initial conditions of the universe at the bounce are ascertained. We found that the initial conditions of the universe are finite owing to the non-vanishing nature of the cosmic factor thus eliminates the initial singularity problem. Furthermore, we show the violation of energy conditions near the bouncing region of our model with respect to linear homogeneous perturbations in Bianchi Type -I cosmological space time convert into FLRW cosmological spacetime for vanishes integrating constant of metric function. Also stability of perturbation equation is highly unstable near the bounce and also unstable for some constraining λ and away from bounce perturbation decay for check its stability at late-times.

Keywords: Bianchi type -I space time; f(R,T) gravity; Matter bounce cosmology; Energy conditions; EoS parameter, linear homogeneous perturbation equation.

ANALYSIS OF POST-COVID-19 RISKS IN THE ELDERLY USING THE CSF-MULTIMOORA TECHNIQUE

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Abstract

Globally, the majority of individuals have been received a COVID-19 vaccination, and its safety has been proven. However, like other vaccinations, they do not completely protect everyone who receives them. Furthermore, information on its efficacy is currently being investigated. The purpose of this research is to examine the post-effects of COVID-19 vaccination in the elderly with major health issues from the perspective of healthcare personnel, taking into consideration the risk of having regular medicines that correlate to the physical and psychological impacts of the chronically ill elderly, and to identify the severely impacted category in the elderly by the multi-attribute group decision making approach.

Keywords : Vaccination, Major health issues, Post COVID-19 pandemic, Elders, MAGDM.

EVALUATION BY USING ANONYMIZATION METHOD OF PRIVACY PRESERVATION TECHNIQUES WITH AN EFFICIENT APPROACH AND A SYSTEMATIC COMPARISON

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Abstract

Data is ceaselessly being gathered because of the inescapability of consistently associated gadgets and the pervasiveness of Internet of Things advancements in individuals' lives. IoT gives the interconnection between different heterogeneous gadgets and sensors that can screen and accumulate a wide range of information about machines and human public activity. Notwithstanding the advantages that can emerge out of gathering information, clients are uncovering touchy and confidential data with perhaps deceitful elements. The tremendous measure of information being gathered about people has brought new difficulties in protecting their security when this information is scattered. Therefore, Protection Saving Information has turned into a functioning examination region, wherein numerous anonymization calculations have been proposed. Notwithstanding, given the huge number of calculations accessible and restricted data with respect to their presentation, it is challenging to distinguish and choose the most proper calculation given a specific distributing situation, particularly for specialists. Here, we play out a precise correlation of notable k-anonymization calculations to gauge their proficiency and their viability. These substances can process, take apart and mine data to remove important information, yet furthermore sell or possibly share the assembled data with pariahs, using it harmfully. With the creating number of maltreatment of data and data breaks, insurance has been another subject and serious security concerns have been animated. To resolve these issues, various Privacy-Preserving Mechanisms (PPMs) and instruments have been proposed.

Keywords : 1. Pervasiveness 2. Privacy preserving 3.Anonymization

SPECIAL SOLUTIONS TO THE FLOW OF INCOMPRESSIBLE FLUIDS COUPLING WITH MAGNETIC FIELD

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Abstract

In this paper we have considered the ideal Magneto hydrodynamics (MHD) equations, which represent the flow of fluid in the atmosphere or ocean in the presence of a magnetic field. We followed the procedure of Majda [1] that was implemented to find special solutions of the rotating stratified Boussines qm equations and found the exact solutions of an initial value problem. Further, we reduce these ideal MHD equations into a system of six-coupled ordinary differential equations, and we conclude that it is a completely integrable system. Finally, we obtained special solutions to the initial value problem.

A NOTE ON AN EQUIVALENT OF THE RIEMANN HYPOTHESIS

SHEKHAR SUMAN,
R.K.DAS

Abstract

In this manuscript we denote by ρ a sum over the non trivialzeros of Riemann zeta function (or over the zeros of Riemann's xi function), where the zeros of multiplicity k are counted k times. Using the Hadamard product of the Riemann xi function, we prove a result that the Riemann Hypothesis is true if and only if

$$\sum_{\rho}\frac{1}{\left|\frac{1}{2}-\rho\right|^{4}}=\frac{1}{2}\left(\frac{\xi''\left(\frac{1}{2}\right)}{\xi\left(\frac{1}{2}\right)}\right)^{2}-\frac{1}{6}\left(\frac{\xi^{(4)}\left(\frac{1}{2}\right)}{\xi\left(\frac{1}{2}\right)}\right)$$

A QUALITATIVE STUDY: THE SUCCESS STORY OF INDIAN WOMEN DESPITE MANY CHALLENGES

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Abstract

In India, there are many women who have succeeded in their lives despite many problems. Empowering women is very important in the present scenario for their holistic development.

In this paper, we will study the different success stories of Indian women in the fields of education, medical, and women with disabilities, their contributions; the different challenges faced by them; and how they cope with those challenges and achieve success in their lives. Also mention the positive ways to overcome mental issues (like stress, anxiety, depression, etc.).

This paper will also give a message to Indian young women that they can review this paper, get inspired, and learn how to cope with the difficult situations in their lives and how to maintain their mental health too. This qualitative study will be helpful for the holistic development of women.

Keywords: Mental Health, Women Contribution, Positive thoughts, India, Women Empowerment, Challenges

BIANCHI TYPE-I UNIVERSE IN PRESENCE OF PERFECT FLUID WITH NUMERICAL SOLUTION

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Abstract :

In this paper, Einstein's field equation in the presence of perfect fluid for Bianchi Type-I universe is considered such that the cosmological term is proportional to $\log R$. Various numerical solution to field equations is discussed. The physical significance of the cosmological models is also discussed

KEYWORDS -Bianchi Type-I universe, Perfect fluid, Variable G , Cosmological model. Numerical solution

INDIAN CLASSICAL MUSIC: A STATISTICAL PERSPECTIVE TO ANALYSE INVOCATION OF EMOTIONS FOR CREATION OF A DIGITAL ALTERNATIVE TO GURUKUL

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MRS.(DR) SANDHYA DHABE

Abstract

Music is known to invoke emotions. Indian classical music has been traditionally tutored through Guru Shishya parampara, which is not plausible now. It is considered that technology can be used as an alternative training aid to bring in semblance of Gurukul type of teaching the improvisation which is an essence of this performing art. An attempt has been made here to prepare a spadework that can be used by software engineers to create the suitable program to achieve this.

Raagas, the melodic structures invoke different emotions. Every raag consists of certain melodic short phrases. It is considered here that it is these phrases that invoke emotions. A statistical analysis was carried out on phrases of various raagas. Since musical notes can be precisely expressed as numerical values in terms of frequencies, a statistical model was arrived at to quantify the phrases to express each with a numerical value we named “Phrase Index”. It was found that this index is extremely effective in qualification of the phrases as to which emotion it will evoke.

Also gram paddhati that deals with mathematical relationships between notes for consonance and dissonance has been made use of to carry out quantification at micro levels, to determine intensity of emotion the phrase would evoke. These qualitative and quantitative analyses have been carried out after a survey and it is considered sufficient a fodder to make a software given the numerical values that can precisely tell quality and quantity of emotion that can be invoked. Under the sets of rules the raagas follow, the software can generate a large number of suggestive phrases for the student to learn. It can also be made interactive wherein, a student can render music and the system works out what emotion is being invoked how intensely.

Keywords: Raag, Phrase Index, Frequency, Gram, Harmony, Consonance, Dissonance

A NEW EASY-TO-USE TOOL FOR QUICK STATISTICAL ANALYSIS

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Abstract

Existing software for statistical analysis such as R, Python, SPSS, MATLAB etc are powerful and multi-purpose and have been in active development for decades. This paper introduces statTools, a new open-source computer program for statistical analysis. The tool distinguishes itself from similar software in that it is far easier to use, is quicker and more portable and has a well-defined roadmap for future development to increase applicability and functionality. It is proposed that statTools will be helpful in classroom environments for students or in field environments for STEM professionals for analysing real-world data on the spot. The current iteration of statTools is showcased in this paper, along with the usage, vision, future plans and brief comparisons with other software tools fitting its use-cases.

Keywords: Computer Program, Statistical Analysis, statTools, Open Source, Matrix Computations, New Software

ANALYSING THE WASTEWATER TREATMENT TECHNOLOGIES: A MULTI-CRITERIA DECISION MAKING APPROACH

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Abstract

The amount of untreated wastewater from domestic and industrial sources poses a threat to the environment and human health. Conventional treatment can remove the harmful contaminants from the wastewater to an extent. As a result, researchers are looking into advanced technologies that would aid in resolving the problem of water shortages and the deterioration of the environment. This paper presents a multi-criteria decision-making model which would help in assessing the treatment technologies based on criteria in determining an efficient treatment technology.

Keywords: Wastewater treatment, Linear diophantine fuzzy set, Decision making, SECA method, effluent removal

ON APPROXIMATE VECTOR VARIATIONAL INEQUALITIES AND VECTOR OPTIMIZATION PROBLEM USING CONVEXIFICATOR

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Abstract

In the present article, we study a vector optimization problem containing locally Lipschitz approximately convex maps in terms of convexificator and give some ideas for approximate efficient solutions. In terms of the convexificator, we approximate Stampacchia-Minty type vector variational inequalities and use them to describe an approximately efficient solution to the nonsmooth vector optimization problem. Moreover, we give a numerical example that attests to the credibility of our results.

Keywords: approximate efficient solutions; convexificator; nonsmooth vector optimization problem; vector variational inequality

EFFECT OF MOVING LOAD AND SHEAR STRESS DISCONTINUITY ON THE FREE SURFACE DISPLACEMENT DUE TO THE SH-TYPE WAVES

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Abstract

This paper investigates displacement at free surface of layered media composed of fiber-reinforced layer overlying orthotropic homogeneous half-space. The analytical expression of displacement is obtained by using Cagniard-de Hoop technique. The integral transforms and method of contour integration is used to evaluate displacement component. The moving load is taken at free surface. The dynamic stress discontinuity is considered at the interface such that the discontinuous stress region moves in the direction of propagation of SH-type waves. Numerical analysis is done by using Simpson's 3/8 method and graphs are plotted using MATLAB software. Special case is derived to validate the model.

Keywords: Stress discontinuity, SH-type wave, Moving line load, Fiber-reinforced composition, Displacement

AN INTEGRATED FUZZY DECISION MAKING MODEL TO IDENTIFY SUSTAINABLE PLASTIC WASTE RECYCLING METHOD

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Abstract

Plastic litter has long been a significant cause of worry, one of the largest obstacles to PWM is the sharp increase in plastic waste production, which has been one of the most important worldwide environmental problems in the last 50 years. We identified nine different types of hurdles that many countries would eventually encounter, along with the difficulties they would have in managing their waste in the face of these impediments. The Intuitionistic fuzzy set (IFS) AHP-PROMETHEE-II, weighing and ranking approach has been used to carry out the evaluation to determine the sustainable plastic waste recycling process under barrier conditions.

Keywords: Plastic Recycling; Waste Management Barriers; MCDM; Intuitionistic Fuzzy Set; AHP; PROMETHEE-II.

MINIMALLY INTERACTING TWO FLUID COSMOLOGICAL MODEL IN $f(T)$ GRAVITY

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Abstract

In this paper, we have investigated the Bianchi type VI_0 cosmological model within the context of $f(T)$ gravity, in which T is the torsion scalar. We have used the source as string clouds minimally interact with dark energy. We have used graphical representations to discuss the behaviour of some geometrical and physical parameters. Additionally, we have calculated a jerk parameter that fits the Λ CDM model and the stability parameter with details.

Keywords: Bianchi Type –VI_0 space-time, Dark Energy, Cosmic String, $f(T)$ Gravity.

BAYESIAN ESTIMATION OF RISK FACTORS FOR MULTIDRUG-RESISTANT TUBERCULOSIS (MDR-TB) IN AMRAVATI BY INFORMATIVE PRIOR APPROACH

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Abstract

Background: Among infectious diseases worldwide tuberculosis (TB) is a serious public health problem. In many high burden countries, including India Multidrug-resistant tuberculosis (MDR-TB) which is another form of TB is a big economic challenge, mainly in providing facilities for its diagnosis and treatment. In India early Detection of MDR-TB and its proper treatment is a priority in National Tuberculosis program.

The present study aimed to determine predictors (risk factors) associated with MDR-TB among the new and old TB patients from Amravati under classical and Bayesian framework both.

STOCK MOVEMENT OF WIPRO LIMITED USING TECHNICAL ANALYSIS

PONSATHYA V, JEEVITHA S

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Abstract

IT Sector is one of the important sectors which plays a vital role in the development of Indian Economy. Wipro Limited is a global information technology, consulting and Business Process Services (BPS) Company. It is the fourth largest company among IT sectors in India. In this paper, we intend to analyse stock movement of the Wipro Limited for the past 2 years. Among various methods available in the technical analysis, in this article, we have preferred Williams %R and RSI (Relative Strength Index). This study helps us to observe the variation and measure the volatility of Wipro Limited.

Keywords: Technical Analysis, Moving Average, Williams %R, RSI.

UNIQUE COMMON FIXED POINT OF MAPS INVOLVING RATIONAL INEQUALITIES VIA COMPLEX VALUED w -DISTANCE

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Abstract

In literature, generalisations have been performed in many ways and one such way is through the metric d. Some authors carried out this process by weakening the assumptions of the metric via dropping its zero self-distance nature, symmetricity or even continuity while some others extended its codomain from $\mathbb{R}$ to $\mathbb{C}$. In this article, we introduce the notion called complex valued w -distance to derive unique common fixed point for a pair of maps satisfying rational inequalities.

BEST PROXIMITY POINT RESULTS FOR CYCLIC (NONCYCLIC) θ -CONDENSING OPERATOR

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Abstract

The main focus of this work is to present the best proximity point (pair) results with the help of measure of noncompactness and θ -condensing operator. The operator allows us to select a class of mappings which is more general then the compact operator.

Mathematical Subject Classification: 54H25, 47H10, 47H09, 47H09, 47H08, 37C25.

Keywords: Best proximity point, compact operator, θ -condensing, Housdorff measure of noncompactness.

PYTHAGOREAN FUZZY RELATION EQUATIONS AND NEW COMPOSITION FOR PYTHAGOREAN FUZZY RELATIONS

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Abstract

In this paper we define matrix representation for binary Pythagorean fuzzy relation (PFR) and also introduce Pythagorean fuzzy relation equations and their solutions for different cases. A new composition for Pythagorean fuzzy relations and their properties are also discussed.

Mathematical Subject Classification: 03E72, 62A86, 68T35, 90B50.

Keywords: Pythagorean fuzzy set, Pythagorean fuzzy relations, Pythagorean fuzzy relation equations.

ANISOTROPIC RECONSTRUCTION OF STRING COSMOLOGICAL MODEL IN *F(R,T)* GRAVITY

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Abstract:

In this Paper, we have considered the spatially homogeneous Bianchi Type – VI cosmological model with cosmic string in a modified theory of $f(R,T)$ gravity proposed by Harko et al.,[1]. Here we consider the shear scalar and scalar expansion to be proportional to each other $(\sigma \propto \theta)$ and taking assumption DP q as negative constant to find exact solutions of the obtained field equations. The physical and geometrical behaviour has been studied by comparing the recent observational data.

Keywords: Bianchi type VI; cosmic string,*f(R,T)*.

SOLUTION OF BOUNDARY LAYER DIFFERENTIAL-DIFFERENCE EQUATIONS USING EXPONENTIALLY FITTED SPLINE METHOD

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Abstract

In this research, we employ the exponentially fitted spline method to find solutions to singularly perturbed boundary layer differential-difference equations under delay and advance parameters**.** Applying the continuity condition to the first-order derivatives of the spline at the interior nodes yields the discrete equation of the problem. A discrete invariant imbedding algorithm is used to process the tridiagonal scheme of the method. To demonstrate the efficacy of the proposed numerical method, we compiled a table of the maximum absolute errors for the standard examples selected from the scientific literature.

Keywords: differential- difference equations, central differences, boundary layer, cubic spline, fitting factor

PLANE SYMMETRIC AND SPHERICAL SYMMETRIC SOLUTION IN $f(R)$ GRAVITY

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Abstract

In this paper, Plane symmetric and spherical symmetric solution in f(R) gravity is discussed. The physical significance of the cosmological models in f(R) is also discussed.

Keywords: f(R) gravity. Cosmological model. Numerical solution

STABILITY OF COLLINEAR LIBRATION POINTS IN RESTRICTED THREE BODY PROBLEM WITH RADIATING MASS AND VARIABLE MASSES

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Dr. Lalan Singh, H.O.D. Mathematics Deptt. Kishori Sinha Mahila College, Aurangabad (Bihar), Pin Code- 824101

Abstract

We investigate the stability of collinear libration points in RTBP with variable masses. We supposed that bigger primary is a source of radiation. The masses of primaries vary isotropically according to unified Meshcherskii law. For the autonomized system, we find that collinear libration points are unstable.

Keywords: Stability, Collinear points, Rediating primary, RTBP, Variable primary masses.

BIANCHI TYPE-I MODELS IN F(R) THEORY OF GRAVITY

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Abstract

In this paper, Bianchi Type-I models in f(R) theory of gravity is discussed. The physical significance of the models in f(R) is also discussed.

KEYWORDS –f(R) gravity. Cosmological model. Bianchi Type-I model.

A FRAUD DETECTION MODEL FOR CREDIT CARD TRANSACTIONS

SURUCHI S. SOMWANSHI, LOPES ROKEY

Abstract

Nowadays credit card is more popular among the private and public employees. A user uses his credit card to purchase durable consumables online and transfer the amount from one account to another. The fraudster is detecting the behaviour of user's transactions and doing illegal activities with the card by phishing, Trojan virus, etc. also threatening the users with their sensitive information. In this paper, we try to build a model for detecting fraudulent activities to improve card transaction security in future which helps credit card companies to recognize fraudulent credit card transactions for betterment of their customers. For this, by collecting data from client which contains numerical input variables categorize in training and test data, which are the result of a PCA transformation and build the model on training data set and verify it using test data for categorizing the transaction as fraudulent and genuine by building a model.

DEVELOPMENT OF MATHEMATICS IN MEDIEVAL ANDHRADESA

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Abstract

Indian mathematicians developed some of the most important concepts in mathematics, including place-value numeration and zero. By developing new techniques in arithmetic, algebra, and trigonometry, medieval Indian mathematicians helped make modern science and technology possible. This paper explains how the mathematics developed and how to use in daily life.

Keywords: Mathematics, Andhradesa, Mallana, Vallabharya, Bhaskaracharya.

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V
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1964 - Hansraj Gupta
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1955 - B. R. Seth

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