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1)

A mathematical model for predicting earthquake occurrence

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Abstract

We consider the continental crust under damage. We use the observed results of microseism in many seismic stations of the world which was established to study the time series of the activities of the continental crust with a view to predicting possible time of occurrence of earthquake. We consider microseism time series model with codal waves as the main source of energy and show that it is an adoptable model for

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Journal of the Nigerian Association of Mathematical Physics
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2)

On a randomly imperfect spherical cap pressurized by a random dynamic load

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Abstract

In this paper, we investigate a dynamical system in a random setting of dual randomness in space and time variables in which both the imperfection of the structure and the load function are considered random , each with a statistical zero-mean .The auto- covariance of the load is correlated as an exponentially decaying function of the time variable .For simplicity, the normal displacement at a point on the shell surface is discretized into a symmetric pre-buckling mode and a buckling mode that has both axisymmetric and non-axisymmetric components. The imperfection is assumed in the shape of the buckling mode with its axisymmetric and non-axisymmetric amplitudes considered random-all with known first and second statistical moments. All these random parameters induce some form of randomness on the normal displacement whose mean square we shall first seek as a suitable statistical characterization of the random process for determining the dynamic buckling load which is determined

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3)

On a lightly damped elastic quadratic model structure modulated by a dynamic periodic load

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Abstract

In this paper, we employ perturbation procedures in asymptotic expansions of the various variables to determine the dynamic buckling load of a lightly damped elastic quadratic model structure modulated by a dynamic periodic load. We finally relate the dynamic buckling load to its static equivalent and show that given any one of them, the

Journal of the Nigerian Association of Mathematical Physics
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4)

Application of the decomposition method to the solution of integral equation with Cauchy Kernel.

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Abstract

Adomian decomposition has been applied to a variety of integral equations with resounding success. Recently Wazwaz applied it to weakly singular second-kind Volterra-type of integral equation. It is the measure of success of the above that has inspired this work. It is our contention that applying the decomposition method to integral equation with Cauchy Kernel will lead to successful result. Indeed as demonstrated in the application below it leads to result with desired accuracy.

***Keywords*:** Integral equation, Cauchy Kernel and decomposition.

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5)

Series solution of singular integral equations

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University of Benin, Benin City, Nigeria.

Abstract

The aim here is to use an appropriate Chebyshev polynomial to produce accurate solution singular integral equations. The method when applied to an example gives accurate result and demonstrates the general applications to singular integral equations.

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6)

Approximate controllability of neutral volterra integrodifferential equations in abstract spaces

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Abstract

In this paper we consider a class of control systems governed by an abstract neutral functional differential equation in Abstract space and study the approximate controllability of the systems using Schauder's fixed point theorem. As application, an example is provided to illustrate the obtained results.

Keywords: Approximate controllability, Schauder's fixed point theorem, neutral functional differential equation, analytic semigroup, linear operators.
2000 Mathematics subject classification: 93B05, 93C20, 35B37.

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***Volume* 14 (May, 2009), pp 59 – 66**

7)

Complete controllability of perturbed infinite delay systems

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Abstract

Sufficient conditions for the complete controllability of perturbed infinite delay systems are eveloped. The results are established using the Schauder's fixed point theorem. An example is also given.
***Keywords*:** Delay systems, perturbation, complete controllability, propernes 200 Mathematics subject classification: Primary 93B05; Secondary 34H05

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8)

On the statistical properties of the non-linear water waves

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Abstract

The study of the statistical properties of the non-linear random wave had been earlier investigated. In this work we introduce a bi-parametric distribution of non-linear stochastic processes, in studying the properties of second-order random processes with a narrow-band spectrum. This incidentally concerns the mechanics of the water waves. In particular, the expressions of the probability density function are further investigated, using this bi-parameter. This analysis will enable the designer to choose wave parameters, within a limit, that will yield an acceptable level of risk. Secondly, such probabilistic based design criterion may result in substantial cost saving if uncertainties in the wave estimates are incorporated.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 73 – 76**

9)

On the non-linear wave in an undisturbed wave field

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Abstract

This work is based on the application of free surface displacement and fluctuating wave pressure in an undisturbed water surface. It is shown that the probability of exceeding wave crest is higher than that of the trough. Using the parameters α_1 and α_2, it is shown that for a fixed kd the effects of non-linearity decrease on approaching the bottom (sea floor) for which α_1 decreases as ky decreases and α_2 increases as ky decreases. These will be valid for most of the second-order processes in the mechanics of the sea waves.

Journal of the Nigerian Association of Mathematical Physics
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10)

The effect of non-linear wave in front of vertical wall using bi-parametric approach

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Abstract

The modification of free surface displacement and fluctuating wave pressure of waves in front of a vertical wall are examined, using the new theoretical approach of a bi-parametric distribution, proposed by Ejinkonye [1] to investigate the effect of non-linearity for the mechanics of the sea waves. The most probable value of the wave steepness is assumed to be $\varepsilon = 0.055$. From the subsequent calculation carried out, it was found that on deep water the parameter α_2 tends to zero and α_1 tends to ε, which is twice as much as the value of α for the progressive waves on deep water. Moreover, for a fixed kd, this theory suggests that the non-linear effects increase while approaching the bottom, which is valid for the mechanics of the sea waves.

Keywords: Free surface displacement, fluctuating wave pressure, narrow spectrum,

Journal of the Nigerian Association of Mathematical Physics
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11)

Optimization of the compressive strength of five-component-concrete mix using Scheffe's theory –a case study of mound soil concrete

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[2]*Civil Engineering Department, University of Nigeria, Nsukka, Nigeria.*

Abstract

The paper presents the report of an investigation carried out to optimize some mechanical properties of a five-component-concrete mix. Mound soil (MS), randomly selected from some habitats of a common tropical specie of termites from Iyeke-Ogba, Nigeria was investigated as a fifth component in concrete. The work applied Scheffe's optimization technique and obtained a mathematical model of the form $f(x_1,x_2,.x_3.x_4, x_5)$ where x, j = 1, 2, 3, 4, 5 are proportions of the concrete components namely; cement, fine aggregate, mound soil, coarse aggregates and water/cement ratio. Scheffe's experimental design was followed to mould various cube samples measuring 150mm x 150mm x 150mm, with different ingredient components which were tested for 7, 14 and 28 days strength. Software for the design of mound soil concrete (MSC) was proposed.

The results show that the optimum mix was 1.00:1.59:0.46:3.34:0.53 with a compressive strength of 43.72N/mm^2. The paper concludes that concrete can be designed as a five component mix in structural engineering rather than using admixtures in undersigned percentages.

Keywords: Concrete, Admixture, Strength, Workability and Fifth-component.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 93 – 96**

12)

An approach for solving linear fractional programming problems

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[2]Department of Industrial and Production Engineering, University of Ibadan, Nigeria.

Abstract
Linear fractional programming problems are useful tools in production planning, financial and corporate planning, health care and hospital planning and as such have attracted considerable research interest. The paper presents a new approach for solving a fractional linear programming problem in which the objective function is a linear fractional function, while the constraint functions are in the form of linear inequalities. The approach adopted is based mainly upon solving the problem algebraically using the concept of duality and partial fractions and an example is given to clarify the developed method.

Keywords: Linear Fractional Programming; Linear Fractional Function, Duality Concept, Objective

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 97 – 104**

13)

An accurate scheme by block method for third order ordinary differential equations.

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Abstract

A block linear multistep method for solving special third order initial value problems of ordinary differential equations is presented in this paper. The approach of collocation approximation is adopted in the derivation of the scheme and then the scheme is applied as simultaneous integrator to special third order initial value problem of ordinary differential equations. This implementation strategy is more accurate and efficient than those given when the same scheme is applied over overlapping intervals in predictor-corrector mode. Furthermore, the new block method possesses the desirable feature of Runge-Kutta method of being self-starting and eliminates the use of predictor- corrector method. Experimental results confirm the superiority of the new scheme over the existing methods.

Keywords: Linear multistep methods (LMMs); P-stability; Zero-stability; Third order; IVPs; Odes; Interval

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 105 – 116**

14)

A new derivation of continuous collocation multistep methods using power series as basis function

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[2]***RDPU*, *Lagos State University, Ojo, Lagos, Nigeria***

Abstract

Some derivations of Continuous Linear Multistep Methods are given in this paper. The paper provides the use of both collocation and interpolation techniques to obtain the schemes. Rather than using Chebyshev polynomials as basis function as it was always done in the past, we introduced the use of direct form of power series as an alternative to the derivation of these schemes. Multistep Methods have over the years been one of the most popular and acceptable methods for generating solutions to initial value problems of Ordinary Differential Equations.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 117 – 124**

15)

Second derivative parallel block backward differentiation type formulas for Stiff ODEs

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Department of Mathematics, University of Benin

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Abstract

A class of second derivative parallel block Backward differentiation type formulas is developed and the methods are inherently parallel and can be distributed over parallel processors. They are L–stable for block size k ≤ 6 with small error constants when compared to the conventional sequential Linear multi –step methods of the same order. Numerical results are presented.

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16)

Generalized Enright block methods for Stiff ODEs

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Abstract

A general theoretical background for a class of parallel second derivative methods is introduced. A parallel block generalization of the Enright second derivative block methods are developed and their stabilities are investigated by means of root locus plots. The resultant parallel methods are found to be L–stable for block size and are of order (k+2).

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17)

On the property of solutions to a system of equations modelling thermal explosion in combustible dusty gas containing fuel droplets with Arrhenius Power-law Model

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Abstract
This paper is essentially devoted to the property of solutions to a system of ordinary differential equations modelling thermal explosion in combustible dusty gas containing fuel droplet with generalised temperature dependent rate of reaction governed by Arrhenius power-law model. Theorems are stated and proofs provided on the qualitative properties of new system equations governing the physical model. New closed-form solutions are obtained based on quadratic approximations to the Arrhenius terms under realistic conditions. The results show that the delay before ignition depend significantly on interphase heat exchange parameter QUOTE α_3 α_3 and energy needed to transfer heat from gas phase to solid phase parameter. It is intended to describe the numerical analysis of the new problem in a later paper.

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***Volume* 14 (May, 2009), pp 151 – 158**

18)

Energy generation in a plant due to variable sunlight intensity

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Abstract
A mathematical model for energy generation in the cells of the leafs of a plant was designed. These modeled equations were solved assuming that the sunlight intensity is not constant. Our present result when compared with that of Mbah and Ezeorah [1] showed that this result as presented is more realistic. It is also shown that variation of the constant terms affect the level of carbohydrate produced. The effect of the sunlight intensity is shown where excessively high sunlight is shown to produce less carbohydrate which we interpreted to mean the deactivation of the enzymatic actions by this high level of sunlight intensity. Particularly, we showed the effect of the term b_2 which is likened to the case of diabetes in man.

Journal of the Nigerian Association of Mathematical Physics
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19)

The effect of extreme-low-frequency electromagnetic field on air borne particles concentration

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Abstract

Electromagnetic fields produce alternating electric fields and modify static electric fields in the vicinity. These electric fields, if large enough, can alter the concentration or transport of airborne particles (including particles harmful to health). In this study, the concentration of radioactive materials (gamma radiation) was monitored around transmission power lines. The result of this study shows that there is an increase in concentration of air borne articles but not high enough to cause health hazard.

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20)

Endemicity of cholera in Nigeria: A mathematical model to investigate its nature

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[2]Department of Mathematics and Statistics, Ambrose Alli University, Nigeria.

Abstract

This work investigates cholera as a disease using mathematical models with emphasis on its endemic nature. The focal point is to investigate the persistent endemic nature of cholera in Nigeria using mathematical model. We found that, there can be no backward bifurcation because there existed only one positive endemic equilibrium. In other words, it is not possible for multiple endemic equilibria to exist if the reproduction number is less than one. Even when reproduction number is greater than one, only a single endemic equilibrium is shown to exist. There was however a transcritical (forward) bifurcation explaining the existence of a single endemic equilibrium.

Keywords: Cholera, mathematical model, endemic equilibrium, reproduction number, backward bifurcations.

Journal of the Nigerian Association of Mathematical Physics
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21)

Detection of cholera outbreaks: A statistical scheme for its detection

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[2]*Department of Mathematics, University of Benin, Benin City, Nigeria*

Abstract

In this paper, cumulative sum (CUSUM) control chart schemes are designed to detect the increase or decrease in the events of cholera outbreaks in Nigeria. The designed schemes are applied on the WHO weekly epidemiological record of cholera cases in Nigeria between 1996 and 2005 to demonstrate the application of the technique. From the demonstration, the technique has a good potential as a tool for detecting cholera outbreaks.

Keywords: Cholera cases, WHO data, CUSUM, Detection, Outbreak.

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22)

Geophysical determination of buried structural features at Ovbiogie village, Edo State, Nigeria.

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Benin City, Nigeria.
[2]***Department of Geology, University of Benin,***

Benin City, Nigeria

Abstract

The result of this paper is to determine geophysically buried structural features using Schlumberger array of vertical electrical sounding. The need to detect riversand/gravel as perched aquifer for clean water production became necessary because of limited resources of pure water in the study area. The research work was done at Ovbiogie village in Ovia North East Local Government Area of Edo State. The vertical electrical resistivity soundings were carried out with maximum current electrode spacing of 928m using six points per decade. Computer iterated data from the study area made the structural determination possible with resistivity values ranging from 85ohm-m to 735ohm-m and depth varying from 1m to 40m. The results obtained obviously showed

the existence of the following structural features; clayey soil at a depth of 1.0m, sandy soil at a depth of 3.0m, clay and mart at a depth of 12.6m, river sand and gravel at a depth of 35.1m and basalt at a depth of infinity.

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23)

Well test analysis of horizontal wells in a two-layered reservoir system: Mathematical derivation

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University of Benin, Benin City, Nigeria

Abstract

In this paper, a well test analysis procedure is discussed for a two-layered oil reservoir drained from each layer by a horizontal well. Reservoir mathematical model are derived for each layer so that analysis can be done strictly for each layered reservoir. Procedures for obtaining all the directional permeabilities, wellbore skin, degree of crossflow and individual layers average pressures are discussed for a pressure drawdown test procedure

Journal of the Nigerian Association of Mathematical Physics
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24)

Weighting factor for instantaneous source functions of a permeable interface

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Abstract

Instantaneous source functions for a layered reservoir with crossflow interface cannot be selected from already existing source functions, if the effects of the interface is to be accounted for. It is therefore necessary to modify the already existing source function. Hence, in this paper, already existing instantaneous source or Green's function is modified to account for the effect of a crossflow interface in a layered reservoir. A multiplicative weighting factor, E, is obtained which shows constant behaviour at late

dimensionless flow times for a particular set of well and reservoir dimensionless parameters. Computation of dimensionless pressures using the factor shows conformity with expected behaviour for a layered reservoir with crossflow interface.

Journal of the Nigerian Association of Mathematical Physics
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25)

Bulk modulus of metals according to structureless pseudopotential model

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Federal University of Technology
Akure, Nigeria.

Abstract

The method for calculating the bulk modulus of metals based on the structureless pseudopotential model was fully developed. The developed method was used to calculate the bulk modulus and kinetic energy contribution to the bulk modulus of 46 elemental metals. The results obtained were compared with experimental values and their variation with electron density parameter was studied. The results obtained revealed that the calculated and experimental bulk modulus of metals varies in the same manner with the electron density parameter. The calculated bulk modulus of metals was in very good agreement with experimental values for the simple metals in the low-density limit and the agreement between the calculated and experimental bulk modulus of metals decreases towards the high-density limit where we have the transition and the noble metals. The results further revealed that the kinetic energy contributes significantly to the bulk modulus of metals and varies in the same manner with the electron density parameter as the bulk modulus. The agreement between the calculated and experimental bulk modulus of metals shows that the structuresless pseudopotential model is promising for predicting metallic properties.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 205 – 210**

26)

The effect of the parameter *ecuti* on the total energy convergence of bulk crystal using FHI98MD code.

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Bayero University, Kano; Nigeria.

Abstract

We have presented the effect of total energy convergence for some bulk crystal in the framework of density-function theory within Local Density approximation (LDA) by using Williams-Solar and Joannopoulos minimization scheme. We have implemented these with a powerful code (FHI98MD). This was achieved by using different values for the parameter ecuti in Rydberg. It has been found that, the value of the parameter ecuti influences the speed and accuracy of the convergence.

Journal of the Nigerian Association of Mathematical Physics
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27)

Empirical formula for the parameters of metallic monovalent halides

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Ekiti State. Nigeria.

Abstract

By collating the data on melting properties and transport coefficients obtained from various experiments and theories for certain halides of monovalent metals, all-inclusive linear relationship has been fashioned out. This expression holds between the change in entropy and volume on melting; it is approximately obeyed by the majority of halides considered and leads to a deficit of entropy on melting for a number of samples. The observed anomalies found explanation in the structural and transport phenomena. The deviating systems e.g. Ag-I belongs to the group of fast-ion conductors in the high temperature crystal phase.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 217 – 222**

28)

Model for structural defect characterization of metals based on positron beam technique

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Abstract

In this work, a model for the structural characterization of metals using positron beam technique was developed and tested. The developed model was tested using experimental data obtained from a positron beam laboratory. The model was based on the Doppler spectrum obtained in the Dopper broadening technique. The model considered specific positron annihilation characteristics in metals. Also, the model considered the properties of positrons as they diffuse through the metals. The S and W- parameters; types of defects can be simulated from the model for any given incident photon energy and for any metal. The results obtained revealed that the S-parameter, the W-parameter and structural defect simulated using the model is in one to one agreement with the experimental values. The model can be used in place of experiments for the structural characterization of defects in metals.

Journal of the Nigerian Association of Mathematical Physics
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29)

Simulation of the optimal size of photovoltaic system using heliophysical variables.

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[2]Department of Physics,

Federal University of Technology, Akure, Ondo State, Nigeria.

Abstract

A method for the optimal sizing of a photovoltaic system is presented in this paper. The system studied is composed of photovoltaic array, power tracker, battery storage, inverter and load. The data used were the sunshine duration and solar radiation intensity for years 1990 to 2004 for eleven Nigerian stations: Calabar, Ibadan, Ilorin, Kaduna, Kano, Lagos, Lokoja, Maiduguri, Minna, Sokoto and Zaria obtained from the archives of the Nigeria Meteorological Agency. Appropriate programs were developed using Matlab^R code to model the optimal size of a photovoltaic system. Input parameters which were estimated from the obtained heliophysical variables and used in the simulation were clearness index and total radiation on an inclined surface. The output parameters include utilizability, monthly-average fraction of the load covered by the photovoltaic system with battery storage, monthly-average fraction of the load covered by the photovoltaic system without battery storage, monthly-average of uncovered load fraction of

the photovoltaic system, area of the panel, optimal area of the panel, total cost of the panel and the optimal total cost of the panel. Maximum incident solar radiation onto the photovoltaic array is obtainable in dry season and smaller sizes of photovoltaic system are used while minimum incident solar radiation onto the photovoltaic array were witnessed during the wet season and larger sizes of photovoltaic system are used, this determines the optimal size of the photovoltaic system. This research also account for the cost of the optimized plant, capable of supplying 15kW, at ₦809,800. A comparison of this researched optimized cost with PHCN (Power Holding Company of Nigeria) current charge indicated that after one year and six months, the user of the photovoltaic plant will become a free user of electricity. The optimized photovoltaic plant is short term cost effective and much cheaper than the non – optimized plant.

Journal of the Nigerian Association of Mathematical Physics
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30)

Application of homotopy perturbation method for the large angle period of a nonlinear oscillator

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Abstract

The homotopy perturbation method is used to determine the period of a nonlinear oscillator. The method produces the result even for large amplitude. The result is compared with others in the literature.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 239 – 248**

31)

Application of Dar Zarrouk parameters to evaluate aquifer transmissivity in Ekpoma, Edo State, Nigeria.

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[2]*Department of Physics, Ambrose Alli University, Ekpoma, Nigeria*.

Abstract

The evaluation of the aquifer transmissivity in Ekpoma area of Edo State, Nigeria, was carried out by the application of the Dar Zarrouk Parameter (DZP). The Schlumberger array configuration in electrical resistivity survey was adopted in acquiring the data. The geoelectric parameters were obtained from the interpretation of the data by the Schlumberger automatic analysis. The average electrical properties of each unit in layered geoelectric section were described by the Dar Zarrouk Parameter and a coefficient of anisotropy. From the evaluation, the study showed that the aquifer transmissivity in the location gives T_{r1}: T_{r2}: T_{r3}: = Kd(2.341×10^6): Kd(2.705×10^6): Kd(2.400×10^6) = (2.341×10^6): (2.705×10^6): (2.400×10^6).

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 249 – 256**

32)

Throughput capacity computation model for hybrid wireless networks

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Abstract

Throughput capacity is a critical parameter for the design and evaluation of wireless networks. We present in this paper, a computational model for obtaining throughput capacity for hybrid wireless networks. For a hybrid network with n nodes and m base stations, we observe through simulation that the throughput capacity increases linearly with the base station infrastructure connected by the wired network, provided that the number of nodes n, does not grow asymptotically slower than .

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 257 – 260**

33)

Horizontal and vertical projectile motion in a resistant medium subject to varying path angles and speed

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Rumuolumeni, Port Harcourt, Nigeria

[4]***Department of Mathematics,***

Niger Delta University, Yenegoa, Nigeria

Abstract

A study of projectile motion in a resistant medium subject to varying path angles and speed was carried out. Solutions to the governing equations of motion is developed employing double integration. Analysis of the results shows that the path of the particle in a resistant medium is affected by both increase in path angle and increase in velocity though the effect is more prominent in the horizontal direction.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 261 – 266**

34)

Effect of a magnetic field on a rotating fluid flow

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[2]***Department of Pure and Applied Mathematics,***

Ladoke Akintola University of Technology, Ogbomoso Oyo State, Nigeria

Abstract

In this paper, we investigate the effect of a magnetic field on a rotating fluid flow in a rotating frame. A system of equations of motion was considered for some components of velocity and magnetic fields. Under some mathematical conditions and assumptions, the system of equations of motion give rise to a differential equation whose result in a graphical representation shows

that the velocity of rotation for the rotating fluid flow increases as the product of the imposed magnetic field increases but as the z-component becomes very large or tends to a very large value, the velocity of rotation for the rotating fluid flow is the same or constant for all the products of the imposed magnetic field.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 267 – 282**

35)

Hopf bifurcations in a fractional reaction–diffusion model for the invasion and development of tumor

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[2]***Department of Mathematics,***

University of Nigeria, Nsukka.

Abstract

The phenomenon of hopf bifurcation has been well-studied and applied to many physical situations to explain behaviour of solutions resulting from differential and partial differential equations. This phenomenon is applied to a fractional reaction diffusion model for tumor invasion and development. The result suggests that more complex hopf bifurcation phenomena are possible when the complexity of the reaction and interaction increases. Results are discussed not only for fractional reaction diffusion equations, but also for ordinary differential equations and standard reaction diffusion equations as well. As a matter of fact, we demonstrated that the reaction-diffusion system portray interesting hopf bifurcation as the complexity of the equation changes. Just to say, a single equation will show hopf bifurcation of lesser complexity than those of a system of equations. The target model is the fractional reaction diffusion model for tumor invasion, conceived and analysed in situ. A uniform hopf bifurcation where the spatial and temporal sub critical and supercritical hopf bifurcations coincide is discussed for this model in a numerical simulation.

Keywords: Hopf bifurcation, tumor, fractional reaction diffusion equations

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 283 – 288**

36)

A derivative and integral characterization of real-valued convex functions of single variable through the geometric chord property

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Abstract

Although convex functions have been characterized using the derivative, integral and monotonicity of the derivative, a characterization which involves a combination of these concepts has not been achieved. This is the centre of this work. In particular we show that for functions enjoying the geometric chord property, this characterization gives equivalence for the definitions of convexity.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 289 – 292**

37)

Derivative of general Heun's equation from some properties of hypergometric functions via polynomial transformations of degrees 2,3,4,5 and 6

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Abstract

The present work determines the solutions derived from the transformation of Heun's equation to hypergeometric equation by rational substitution.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 293 – 298**

38)

An elastic bimaterial cylinder under anti-plane shear

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Abstract

This analysis of the stress distribution in an elastic bimaterial cylinder reveals that the stresses are nonsingular along the interface if the prescribed shear stresses remain finite. The stresses σ_{jrz} (r,θ), $\theta = 0, \pm\pi$, $j = 1, 2$ in the radial direction will varnish if the material becomes homogeneous and the loads self equilibrating. The stresses in the angular direction, $\sigma_{j\theta z}$ (r,θ), $\theta = 0, \pm\pi$, $j = 1, 2$ which tend to tear the interface are also not singular if the loads remain finite but varnish if the loads are equal.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 299 – 304**

39)

Longitudinal fields due to a rigid line inhomogeneity in a nonhomogeneous cylinder

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Abstract

A non-homogeneous elastic cylinder of radius a containing a rigid line in-homogeneity under longitudinal share is analyzed for elastic compatibility. The fields were derived in a closed form with each shown to depend only on the traction prescribed on the material it represents unlike in the case of bimaterials of the same geometry under similar loading. The stress fields are not singular and satisfy conditions of continuity across the inhomogeneity thereby showing compatibility between the matrix and the inhomogeneity.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 305 – 310**

40)

On the multiplicity effect of an *m*-fold moving point load on the dynamic response of an Euler beam resting on a Kelvin foundation.

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Abstract

In this work the response of an elastic beam supported by viscoelastic foundation (Winkler Model) to an external excitation (force) is investigated with particular attention to the efect of the excitation by a multipple cyclic moving load. The effect of the multiplicity of the cyclic - moving load with respect to the amplitude of vibration of the structure is examined. It was. It was observed that the multipple load system has a multiplicative effect on the condition of the resonance of the beam – moving load on the condition of the resonance of the beam – moving load system.

Keywords: Multibeam, visco-elastic foundation, winkler model

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 311 – 324**

41)

Analysis of temperature distribution in a heat conducting fiber with convection losses using finite element method

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Abstract

The temperature distribution in a heat conducting fiber is computed using the Galerkin Finite Element Method in the present study. The weak form of the governing differential equation is obtained and nodal temperatures for linear and quadratic interpolation functions for different mesh densities are calculated for Neumann boundary conditions. The results show that using a mesh of three quadratic elements produces a maximum error of 0.622 compared to 1.1832 for a similar number of linear elements. It is concluded that as the mesh is refined further progressively, the finite element solution approaches the exact solution admirably. The results are displayed in both graphical and tabular forms.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 325 – 334**

42)

Thermosolutal MHD flow and radiative heat transfer with viscous work and heat source over a vertical porous plate

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Abstract

This paper investigates double diffusive convection MHD flow past a vertical porous plate in a chemically active fluid with radiative heat transfer in the presence of viscous work and heat source. The resulting nonlinear dimensionless equations are solved by asymptotic analysis technique giving approximate analytic solutions for the steady velocity, temperature and concentration. The parameters involved are used to give pictorial illustrations of the distributions of the flow variables and are discussed. Also the shear stress, heat and mass transfer characteristics in terms of the flux rates at the plate wall are discussed.
Keywords: Heat source; Optically thin incompressible fluid; thermosolutal MHD flow
AMS Subject Classification: 76W05, 76R10, 76R50, 76V05, 76S05

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Volume **14 (May, 2009), pp 335 – 340**

43)

Thermally radiating fluid: Approximations of integral solutions

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Abstract

This paper examines thermally radiating fluid. Integral solutions are presented which are evaluated numerically. A new and simpler approach to the approximate form of the integral

solutions is presented that gives rise to approximate analytical solutions. It is shown that the results reveal the characteristics of the problem and compare favourably well.

Keywords: Integral solutions, numerical integrations; optically thin incompressible fluid; thermally radiating fluid
PACS numbers: 61.80.Az, 95.30.Jx

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 341 – 348**

44)

Convergence profile of a discretized scheme for constrained problem via the penalty-multiplier method

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Abstract

An extended discretized scheme is proposed to examine the convergence profile of a quadratic control problem constrained by evolution equation with real coefficients. With an unconstrained formulation of the problem via the penalty-multiplier method, the discretization of the time interval and differential constraint is carried out. An operator, to circumvent the cumbersome calculation inherent in some earlier schemes, such as the function space algorithm, is established and proved. An example is considered to test the effectiveness and superiority of this scheme as it compares to other schemes in terms of convergence profile.

Keywords: Convergence, evolution, penalty-multiplier, operator.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 349 – 358**

45)

Comparison of second and third orders Runge-Kutta methods for solving initial-value problems in ordinary differential equations

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[3]Department of Pre-ND Sciences, Auchi Polytechnic, Auchi.

Abstract
This work is concerned with the analysis of second and third orders Runge-Kutta formulae capable of solving initial value problems in Ordinary Differential Equations of the form: $y^1 = f(x, y)$, $y(x_0) = y_0$, a £ x £ b. The intention is to find out which of these two orders can improve the performance of results when implemented on the initial-value problems defined above. We found out that the higher the order, the better the performance of that order. When parameters are properly varied, performance may also improve.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 359 – 366**

A step-by-step approximation and analysis of asymptotic stability properties of solution of retarded system

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Abstract
The special transcendental character of the characteristic equations of the retarded differential systems makes it difficult to analyze the system equation. Researchers have used various acceptable mathematical techniques to address the issue. In this paper, the convergent properties of an integral equation equivalent of a retarded system are used to establish the existence and uniqueness of the solution of retarded differential equations. A step-by-step approximating technique is employed in formulating a numerical method of solving an initial value problem of the retarded system and the solution is presented in the form of a finite series. The asymptotic stability properties of the solution are investigated. Results obtained are comparable to the general solution form of the ordinary differential equations.
Keywords: Retarded differential equations, existence and uniqueness, step-by-step approximation, asymptotic

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 367 – 376**

Computational result of integral quadratic objective functional with wave-diffusion effect

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Abstract

This work is on computational result of integral quadratic objective functional with wave-diffusion effect, which is in the form:

$$\left.\begin{aligned} &MinJ[u,z] = \int_0^1\int_0^1 \left(u^2 + z^2\right)dx\,dt \\ &\text{Subject to} \\ &\frac{1}{c^2}\frac{\partial^2 z}{\partial t^2} + \frac{1}{d}\frac{\partial z}{\partial t} = \frac{\partial^2 z}{\partial x^2} \\ &z(0,t) = z(1,t), 0 \le x \le 1 \\ &z(x,0) = z(x,1) 0 \le t \le 1 \end{aligned}\right\}$$

*where u(x,t) is the control and z(x,t) is the states of the system. On the application of the Hamiltonian function we derived the states and controls which satisfy optimality condition. A suitable Fourier solution is applied to obtain the states and controls in the form of a series solution. Also, the states and controls in the form a series solution can also be obtained by use of EXTENDED CONJUGATED GRADIENT METHOD (ECGM) proposed by Ibiejugba [7] and Reju [8]. The work also consists of numerical solutions which are optimal.

Keywords: Optimal solution, Integral Quadratic Objective Functional, Fourier Solution, Diffusion,

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 377 – 380**

Comparative performance of autoregressive order determination criteria for subset modelling

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Abstract

The efficiencies of eight autoregressive model order determination criteria: AIC, BIC, SIC, S, F, FPE4, CAT_2, CAT_3, for the selection of subset models are compared using artificial and real series. Our observation is that BIC, S and FPE4 performed well in a wide range of models.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 381 – 388**

Mathematical modelling of the calcination process

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Federal University of Technology, Minna, Nigeria.

[4]Department of Pure and Applied Mathematics,

Ladoke Akintola University of Technology, Ogbomoso, Nigeria.

Abstract

High quality lime is an essential raw material for Electric Arc Furnaces and Basic Oxygen Furnaces, steelmaking, alumina production etc. Decrease in fuel consumption in metallurgical furnaces is a tremendous opportunity for reduction of greenhouse gas emissions into the atmosphere. In this paper, a mathematical model of calcination process was studied. An analytical solution is obtained for the model. From the numerical simulation, it is observed that the gas temperature increases as the activation energy and Frank-Kamenetskii parameter increases. It is also observed that the material temperature decreases with increase in activation energy while it is increases with increase in Frank-Kamenetskii parameter.
Keywords: high quality lime, shaft furnace, fuel rate, fuel combustion, limestone calcination

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 389 – 394**

A mathematical model of combustion kinetics of municipal solid waste (MSW)

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Federal University of Technology, Minna, Nigeria.

Abstract

Municipal Solid Waste has become a serious environmental problem troubling many cities. In this paper, a mathematical model of combustion kinetics of municipal solid waste with focus on plastic waste was studied. An analytical solution is obtained for the model. From the numerical simulation, it is observed that the heating rate β is proportional to the heating temperature and the conversion rate of the system. It is also observed that the conversion rate increases as the pre-exponential factor increases while it decreases as the activation energy and reaction order increases.

Keywords: Combustion kinetics, municipal solid waste, pseudo-part, waste plastic

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 395 – 406**

51)

The construction of optimal hedging portfolio strategies of an investor

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[2]Department of Mathematics, University of Ibadan,

Ibadan, Oyo State, Nigeria.

Abstract

We consider the process of constructing an optimal hedging portfolio strategies of an investor. This require the hedging out of risks associated with an investor's portfolio process. In order to achieve this, there is the need for portfolio diversification, that is, investing into different number of investment firms. When the returns from a firm falls below expectation, the returns from other firms can be use to complement the loss. We categorised the investor's portfolio into two folds: the initial investment and the capital gain. Our aim is to construct an hedged portfolio process that can capture all the investor's investment in i, i = 1, 2, …, N investment company at time t, using stochastic differential equation for derivative pricing process. We will also describe the dynamic of our stock price using Binomial lattice model. We also intend to apply Hamilton-Jacobi-Bellman,(HJB) equation to derive the optimal values of our trading strategies. We assume in this paper that the investor is risk averse. Therefore, we adopt an exponential utility function known as Constant Absolute Risk Aversion, (CARA) and maximise the expected final utility function of the investor.

Volume **14 (May, 2009), pp 407 – 416**

52)

Premium adjustment: actuarial analysis on epidemiological models

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[2]School of Business Studies,

Edo State Institute of Technology and Management, Usen, Edo State, Nigeria.

Abstract

In this paper, we analyse insurance premium adjustment in the context of an epidemiological model where the insurer's future financial liability is greater than the premium from patients. In this situation, it becomes extremely difficult for the insurer since a negative reserve would severely increase its risk of insolvency, or might cause bankruptcy. This situation might also make many policy holders withdraw from the insurance by simply terminating their premium payments. It is proved that the benefit reserve changes from negative to positive and from concave to convex under the condition stated in Proposition 5.3 of this paper. As the premium tends to optimum premium rate, the local maximum in the first arch approaches the local minimum in the second arch and they all converge at a time point t_m. As a result, the reserve benefit shifts upwards as the premium rate increases. It is concluded that a proper premium rate between initial and optimum premium rates exist in order to fulfil certain reserves requirements and an algorithm to determine this value was developed.

Keywords: Premium rate, Premium payment, Reserve requirement.

Volume **14 (May, 2009), pp 417 – 422**

53)

A continuous-time control model on production planning network

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[2]*Department of Mathematics*

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Abstract

In this paper, we give a slightly detailed review of Graves and Hollywood model on constant inventory tactical planning model for a job shop. The limitations of this model are pointed out and a continuous time production model that allows work to travel through more than one station within a single time period is derived. With the relaxation of the period size limitation, we were able to match the time period within the production time frame. This is our major contribution. Unlike Graves and Hollywood model where job visit at most one workstation in each period.

***Volume* 14 (May, 2009), pp 423 – 434**

Extended period simulation (EPS) modelling of urban water distribution network

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Abstract

A WaterCAD hydraulic network model of the existing Ikpoba Hill Benin City Water distribution network was constructed, calibrated and validated for extended period simulation studies using the network's physical, operational, calibration and validation data. The model was then applied to evaluate: (i) effects of fluctuating water demand on system storage over 24 hour period and (ii) level of service and storage conditions during and following an emergency condition e.g. fire. Our results indicate that the existing system storage capacity (276m^3) is inadequate to meet operational, emergency and fire requirements for the present and future needs of the system. However, increasing the existing system storage capacity to 1300m^3 at the same Hydraulic Grade Line (HGL) will meet the system demand up to 2015.

Keywords: EPS, Network model, WaterCAD, Steady state, Fire flow, and Hydraulic Grade Line (HGL)

***Volume* 14 (May, 2009), pp 435 – 438**

Assessment of water quality of Ikpoba River, Benin City using d.c. conductivity

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[2]Department of Physics

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Abstract

The d.c. conductivity of Ikpoba, River was measured with a view to ascertaining the quality of the water. The d.c. conductivity of Ikpoba River ranges from 400ms/cm - 500ms/cm. This was compared to that of a popular brand of bottled water in the city which has a d.c conductivity of 180ms/cm (Table 3). The measurements show that a lot of ions are present in the river water. The origin of such ions is believed to be by-products of organic wastes deposited in the river by some industries located along its banks.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 439 – 448**

56)

Effects of noise-induced hearing loss within Port Harcourt metropolis, Nigeria.

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[2]Department of Mathematics, Rivers State University of Science and Technology,

Port Harcourt, Nigeria,

Abstract

This paper investigates the effects of Noise-Induced Hearing Loss within Port Harcourt Metropolis using a micro-controlled diagnostic audiometer (Kamplex KLD21).The data was obtained at two specific locations namely: Rivers State University of Science and Technology and Port Harcourt International Airport. The measurements showed that the highest noise intensity level at Rivers State University of Science and Technology is 120dB with noise-induced hearing loss of 35dB (air and bone conduction) at audiometric frequency of 4000Hz, while the airport has the highest noise intensity level of 107dB (air conduction audiometry) and 75dBA (bone conduction audiometry) at 4000Hz. The normal recommended hearing level is 5dBA at 4000Hz.These data confirm that many of the subjects tested at the two locations are affected by Noise-Induced Hearing Loss (NIHL)

Keywords: Air conduction audiometry, Bone conduction audiometry, noise-induced hearing, impairment, Audiometry, Transducer.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 449 – 462**

57)

Modelling the Nigerian Defence Academy cadets' monthly sick-parade using time series classical decomposition method

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Abstract

The Nigerian Defence Academy (NDA) has no sick parade model that can enhance adequate planning and resource allocation. This research tackled this problem by developing a model that will assist in decision making policies.

Keywords: Classical decomposition, sick-parade, forecasting, fitting seasonal index, deseasonalized data,

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 463 – 468**

58)

Glucose level in the body of a fasting non-diabetic person

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Abstract

This study shows that the source of glucose to the cells of a fasting individual is not exclusively from the stored glucose in the Liver as this is shown to be exhausted within a very short period of time. For fasting to last for a relatively long time, it is shown that the rate of release of stored glucose in the Liver as well as the production of glucose by the Kidney and other parts of the body, must vary over the period of time in question.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 469 – 478**

Coefficients and constants in the partial fractions of some trigonometric inverse functions

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Abstract

This Paper extend the work done by Daniel and Tella, [1] and Ogbereyivwe, Emumejaye and Ekeh, [3] to trigonometric inverse functions. It determines the unknown constants and coefficients in resolving rational functions containing trigonometric inverse functions in their denominator, into the sum of its partial fractions equivalent by recursive method. For each of the cases of functions considered, a recursion formular was derived and the trend of these constants and coefficients were examined as n tends to infinity.

Journal of the Nigerian Association of Mathematical Physics
Volume **14 (May, 2009), pp 479 – 484**

Periodic solutions of a certain nonlinear boundary value problem (BVP) of a fourth order differential equation

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Ebonyi State University, Abakaliki, Nigeria.

Abstract

The consideration of the eigenvalue approach and a comparison between the linear and nonlinear fourth order differential equation formed the basis for a theorem for existence of periodic solutions for the nonlinear boundary value problem of a fourth order differential equation. The proof of the theorem is by the Leray-Schauder fixed point technique with the use of integrated equation as the mode for estimating the a priori bounds.

Keywords: Nonlinear ODE, Boundary value problem (BVP), a priori bounds, integrated equation, Leray-Schauder

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 485 – 492**

61)

Periodic solutions for a boundary value problem of a third order ordinary differential equation

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Abstract

Existence results for some non-linear ordinary differential equations (1.1) – (1.2) have been very difficult to establish when it comes to computation of the apriori bounds. These difficulties were due to the nature of Lyapunov functions involved. In this paper, these difficulties have been avoided by the use of integrated equation as the mode of estimating the apriori bounds.

Journal of the Nigerian Association of Mathematical Physics
***Volume* 14 (May, 2009), pp 493 – 500**

62)

A mathematical model for malaria treating both sensitive and resistant strains in a multigroup population

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Abstract

The emergence of drug-resistant malaria parasites in recent years has become a significant public health problem. Drawing from our ealier models [2], which deal with a single population group, a multigroup model is hereby introduced. Human population is assumed fixed in all considerations while that of vectors varry. All the models are nonlinear ordinary differential equations models. The models describe accurately, the current trend in malaria infection in a malaria endemic region. Our focus in analysing the models is on the possibility of establishing some positive asymptotic equilibria. It is shown that (under suitable conditions) the equilibrium points are (globally) asymptotically stable. As a function of some interplay between the various parameters, the equilibrium can lead to endemic infection with sensitive infection only, resistant infection only, or both, or to elimination of both infections. The biological significance of these equilibrium points, namely, their usefulness to practical health officials, also emerges as a byproduct.

Keywords: Asymptotically stable, Equilibrium points, Feasible points, Gametocytes, Resistant parasites, Sensitive