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1. Anti-synchronization of the rigid body exhibiting chaotic dynamics

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Abstract

Based on a method derived from nonlinear control theory, we present a novel technical approach for synchronizing the dynamics of a rigid body exhibiting chaotic motion. In this
framework, the active control technique is modified and employed to
design control functions based on Lyapunov stability theory and
Routh-Hurwitz criteria, so that a drive-response system of a rigid
body achieves anti-synchronism in the chaotic state. Global
asymptotic stability and convergence of the sum of the dynamical
variables representing the Eulerian state space of the two rigid bodies
was verified by numerical simulations.

2. Anti-synchronization of two new different chaotic systems via active control

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Abstract

This paper investigates the anti-synchronization of chaos
between two new different chaotic systems by using active control.
Numerical simulations are used to show the robustness of the active
control scheme in anti-synchronizing the two different coupled
systems.
3. A new analytical solution to the diffusion problem: Fourier series method

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Abstract
This paper reviews briefly the origin of Fourier Series Method. The paper then gives a vivid description of how the method can be applied to solve a diffusion problem, subject to some boundary conditions. The result obtained is quite appealing as it can be used to solve similar examples of diffusion equations.

4. On regular algebraic monoids

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Abstract
This paper provides a proper identification of normal irreducible, regular algebraic monoids. The result of [3,4] suggests that we should be able to find a classification of these monoids in terms of their unit groups, and related toroidal data. That is what we accomplish in this paper.
5. On the number of cyclic quotients of some Abelian $p$-Groups

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Abstract

We determine in this paper, the precise number of cyclic quotients of Abelian $p$-groups of exponent $p'$ and rank $r > 1; i = 1$ and 2.

6. Diffeomorphism groups of connected sum of three products of spheres

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Abstract

In this paper, we will prove that the order of the group $\pi_0(M^+_{3(p,q)})$ is 3 times the order of the group $\pi SO(q + 1) \oplus \pi SO (p + q + 1)$ where $p < q$ and $M^+_{3(p,q)} = Diff^+$

$(S^P \times S^q \# S^P \times S^q \# S^P \times S^q)$. $Diff^+(M)$ is the diffeomorphism of $M$ onto itself which induces identity homomorphism on homology.
7. Subgroups of Group of homotopy spheres

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Abstract

Let $\Theta$ denote the group of h-cobordism classes of homotopy $n$-sphere under the connected sum operation. $H(p, q)$ is the subgroup of $\Theta$ consisting of those homotopy $p$-spheres $\sum^p$ such that $\sum^p \times S^q$ is diffeomorphic to $S^p \times S^q$. Also $bP_{p+1}$ is the subgroup of homotopy $p$-sphere which bounds parallelizable manifolds. In this paper, we will prove that $H(p, q)_{bP_{p+1}}$ is isomorphic to the Cokernel of Hopf-Whitehead homorphism $J : \prod\pi_{p} So(q + 1) \rightarrow \prod\pi_{p+q+1}(S^{q+1})$.

8. On the equivalence of Picard, Mann and Ishikawa iterations for a class of quasi-contractive operators

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Abstract

We show that the Picard, Mann and the Ishikawa iterations are equivalent when applied to a class of quasi-contractive operators. This result generalises that of Soltuz among others.
9. Mann iteration with errors for strictly pseudo-contractive mappings.

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Abstract

It is well known that any fixed point of a Lipschitzian strictly pseudo-contractive self mapping of a nonempty closed convex and bounded subset $K$ of a Banach space $X$ is unique [6] and may be norm approximated by an iterative procedure. In this paper, we show that Mann iteration with errors can be used to approximate the fixed points of strictly pseudocontractive mappings. Our result extend the corresponding result obtained by Liu [6].

10. On some functional associated with certain coefficient problems

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Abstract

Under certain conditions, we obtain sharp bounds on some functionals defined in the coefficient space of starlike functions. It has been found that the functionals are closely associated with certain coefficient problems, which are of independent interest.
11. Quasi-Partial sums of the generalized Bernard integral of certain analytic functions

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Abstract

In this short note we extend a result of Jahangiri and Farahmand [5] concerning functions of bounded turning to a more general class of functions.

12. On the existence of continuous selections of solution and reachable sets of quantum stochastic differential inclusions

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Abstract

We prove that the map that associates to the initial value the set of solutions to the Lipschitzian Quantum Stochastic Differential Inclusion (QSDI) admits a selection continuous from the locally convex space of stochastic processes to the adapted and weakly absolutely continuous space of solutions. As a corollary, we show that the reachable sets admit some continuous selections. In the framework of the Hudson - Parthasarathy formulations of quantum stochastic calculus, our results are achieved subject to some compactness conditions on the set of initial values and on some coefficients of the inclusion. The results here compliment similar results in our previous work in [3] where continuous selections defined on the set of the matrix elements of initial values were established.
13. Horizontal and vertical projectile motion in a resistant medium under the influence of transverse magnetic field

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Rivers State College of Education, Rumuolumeni, Port Harcourt, Nigeria.

Abstract

Horizontal and vertical projectile motion in a resistant medium under the influence of magnetic field is carried out. Solutions to the governing equations is developed using integrating factor method. The results are in reasonable agreement with the findings of [2] and [3].

14. The effects of permeability and radiation on the stability of plane Couette-Poiseuille flow in a porous medium

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Abstract

A study on the effects of permeability and radiation on Couette-Poiseuille flow stability was carried out. Solutions to the governing hydrodynamic equations was developed using the method of undetermined coefficients. On the basis of linear theory using analysis of normal modes, it was observed that both parameters, independently affect the stability of Couette-Poiseuille flow but that of radiation is prominent at high wave numbers and Reynolds number regime.

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Abstract

We examine a free boundary value problem related to auto ignition of combustible fluid in insulation materials. The criteria for the existence of similarity solution of the model equations are established. The conditions for the existence of unique solution are also stated. The numerical results which show the influence of activation energies on the three-component model of the chain reaction also identify the ignition point of the combustible fluids.

16. Mathematical analysis of the global dynamics of a model for HIV infection of CD4⁺ T cells

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Abstract

We analyze a mathematical model that describes HIV infection of CD4⁺ T cells. We are interested in the effect of a small addition of infection on an equilibrium state. Using Rene Descartes’ theory of solutions, we show that if the so called basic reproduction number \( R_0 < 1 \), the infection will eventually die out, but if \( R_0 > 1 \), then the infection will lead to full blown AIDS. In either case \( R_0 \) is important in the eventual growth of the disease.
17. Numerical solution of heat and mass transfer in MHD flow in the presence of chemical reaction and Arrhenius heat generation of a stretched vertical permeable membrane

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Abstract

We present a magnetohydrodynamic flow of a uniformly stretched vertical permeable surface undergoing Arrhenius heat reaction. It is shown that the temperature, concentration and the velocity fields depend on the chemical reaction parameter. The values of temperature field increase as the order of the reaction increases, while that of velocity field decreases as the order reaction increases. Moreover, the reactant field decreases faster as we move away from the wall as we increase the reaction parameter. This paper also shows that the temperature field and reacting layers get thinner as the heat deposit Q per unit mass increases while the velocity field and the boundary layer get thinner as thermal Grashof number increases. We also show that magnetic induction and cooling of the plate (thermal Grashof number Grt>0) lowers the velocity field.

18. MHD flow of a uniformly stretched vertical permeable membrane in the presence of zero order reaction and quadratic heat generation

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Abstract

We present a magneto - hydrodynamic flow of a uniformly stretched vertical permeable surface undergoing Arrhenius heat reaction. The analytical solutions are obtained for concentration, temperature and velocity fields using an asymptotic approximation, similar to that of Ayeni et al 2004. It is shown that the temperature field and the velocity field depend heavily on the thermal grashof numbers, heat generation/absorption, magnetic induction, chemical reaction parameters and reaction order. It is also established that maximum velocity occurs in the body of the fluid close to the surface and not the surface.
19. Magnetic and velocity fields MHD flow of a stretched vertical permeable surface with buoyancy in the presence of heat generation and a first order chemical reaction

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Abstract

Analytical solutions for heat and mass transfer by laminar flow of Newtonian, viscous, electrically conducting and heat generation/absorbing fluid on a continuously moving vertical permeable surface with buoyancy in the presence of a magnetic field and a first order chemical reaction are reported. The solutions for magnetic and velocity fields are obtained for various thermal grashof number, mass grashof number, Hartmann number, and magnetic buoyancy. The effect of various parameters on skin friction coefficient $C_f$ were also examined and reported. Graphical illustration features prominently in this work.

20. Computational model for speed of efflux in liquids

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Abstract

We have looked at the efflux of a viscous liquid from an orifice. Assuming the steady flow of a Newtonian fluid, a model for the energy loss due to viscous shearing stress is derived, and a first-order non-linear ordinary differential equation of second degree is obtained for the speed of efflux. Numerically, the equation is quasi-stiff, due to the small value of kinematic viscosity of common liquids. We resolve the equation numerically using a modified Rosenbrock formula for the speed of efflux at different depths of the orifice, below the free surface of the liquid. Generally, the results show that the speed of efflux for a liquid with a large kinematic viscosity is lower than that for a liquid with a small kinematic viscosity at any particular depth. At a low hydrostatic pressure, the speed of efflux of a viscous liquid is less than that of an inviscid fluid. Thus there is a significant energy loss if the kinematic viscosity of a liquid is high. Also, the results suggest that liquids with a large kinematic viscosity are more likely to support steady flow if subject to a high pressure gradient.
21. Mathematical model of the bacteria-nutrient dynamics

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Abstract

In this paper we developed a Mathematical Model of bacteria-nutrient dynamics which results in a system of first order ordinary differential equations. The analysis of the model was done using dynamical systems. It was found out that the product of the maximum nutrient uptake per cell; and the number of cells produced per unit of nutrient uptake is a constant \((VY = \ln 2)\). It is also shown that there is a linear relationship between the concentration of the limiting nutrients and number of bacteria with a negative slope. It is finally shown that after a long time, the number of bacterial will be a constant and will depend on the initial concentration of the nutrient and the initial number of bacterial.

22. Mathematical model of epidemics with intermediate classes

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Abstract

In this paper we present a Mathematical model for diseases that place some new recruits from the susceptible class into an “exposed but not yet infectious” class which we denote by \(E\). The rest of the susceptible class can be infected directly. The model is developed and its steady state determined. The stability of the steady state was analyzed and it was found that the steady state is a saddle point. The disease free steady state was also analyzed and it was shown that it is stable if \(N < \gamma/\beta\). This means that it may easy to achieve a disease free state provided the population size has a bound, \((N < \gamma/\beta)\).
23. Improved family of block methods for special second order initial value problems [I.V.Ps].

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Abstract

In this paper, efforts are directed towards generating a 2-block 3-point numerical method for solving the special second order initial value problems of the form $Y'' = F(X, Y)$, $Y(0) = Y_0$, $Y'(0) = Y_{00}$, where $Y'$ is the total derivative of $Y$ with respect to $X$. The scheme so developed, is an extension of Aladeselu, V.A (2006)[1], in which a 2-block 2-point scheme was developed. The scheme is of orders $8/9$, zero-stable and convergent. It is thus possible, with this scheme, to assign computational tasks at 3 points within the block to three different processors working simultaneously.


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Abstract

Continuous linear multi-step methods (CLMM) form a super class of linear multi-step methods (LMM), with properties that embed the characteristics of LMM and hybrid methods. This paper gives a continuous reformulation of the Enright [5] second derivative methods. The motivation lies in the fact that the new formulation offers the advantage of a continuous solution of the initial value problem (IVP) unlike the discrete solution generated from the Enright’s methods. The success of these methods is in their attainable stiff stability characteristics useful for resolving the problem posed by stiffness in the IVP. In this regard we derive a family of variable order continuous second derivative hybrid methods for the solution of stiff initial value problems in ordinary differential equations. A numerical example is given to demonstrate the application of the methods.

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Abstract

In this paper, we introduce a continuous extension of second derivative linear multi-step methods with a hybrid point for the numerical solution of initial valued stiff ordinary differential equations. The continuous extension is based on the Gear’s fixed step size backward differential methods [7]. The intervals of absolute stability of methods of step number \(k \leq 7\) are determined using the root locus plot. Numerical results of the methods solving a non-linearly stiff initial value problem in ordinary differential equations are compared with that from the state-of-the-art ordinary differential equations code of MATLAB discussed in Higham et al [9].

26. Constructing the operator matrix for the optimal control of linear lower order non-dispersive waves
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Abstract

Non-dispersive waves propagate with constant phase velocities therefore they are indispensable in communication and some other areas of application. This paper constructed the Operator, \(R\), for the control of linear lower order non-dispersive wave equation using the extended conjugate gradient Method proposed in [2]. The work of Ibiejugba et al, [3] was on the role of multipliers in the multiplier method which was applied to dynamical system. This work involves system governed by first order partial differential equation, namely linear lower order non-dispersive wave.
27. The control operator for the optimal control model of higher order non-dispersive waves

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Abstract:

The control operator of the Extended Conjugate Gradient Algorithm for the control of two-dimensional higher order non-dispersive waves was constructed in the paper. Explicit expressions of each element, $R_{i,j}$, of the operator, $R$, were computed. These elements are useful for the implementation of the Optimal Control Formulation of the model.

28. A Genetic algorithm for evaluating the zeros (roots) of polynomial functions, optimizing and solving $n$-dimensional systems of equations

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Abstract

This paper presents a Genetic Algorithm software (which is a computational, search technique) for finding the zeros (roots) of any given polynomial function, and optimizing and solving $N$-dimensional systems of equations. The software is particularly useful since most of the classic schemes are not all embracing. For example; Newton-Raphson Scheme can only solve the zeros (roots) of polynomial, while and Gauss-Jordan scheme can only solve set of linear simultaneous equations. This characteristics of classical schemes, thus pose a limitation to the scope of problems they can they can used to solve. This limitation is effectively and accurately easily resolved using the genetic algorithm programme. It is demonstrated using a number of examples. Thus it solves a wider class of optimization problems, and also solves for the zeros or roots of polynomial. The program was designed and implemented using Microsoft Visual Basic object oriented programming Language.
29. Finite element solution of the Boussinesq wave equation

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Abstract

In this work, we investigate a Boussinesq-type flow model for nonlinear dispersive waves by developing a computational model based on the finite element discretisation technique. Hermite interpolation functions were used to interpolate approximation elements. The system is modeled using a time dependent equation. Solution to the model is obtained, through a combination of two different schemes namely: a time approximation scheme (the Newmark Method) and the eigenvalue finite element method. Using this schemes, discrete solutions of the model at different time steps, were obtained. Graphical illustrations of solutions for the transient displacements at the center and right end of the rod are presented. The results obtained are very accurate and the model efficient.

30. An algorithm for numerical solution of Anisimov coupled differential equation of heat transfer from electron to lattice

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Abstract

This paper proposes a way of obtaining non-equilibrium transient electron-lattice temperature of several thousands of Kelvin in semiconductor thin films by applying satisfactorily boundary conditions to Anisimov coupled differential equations. This is possible by adjusting some of the parameters in the equations and tailoring the characteristics of semiconductors to achieve an enhanced transient carrier concentration and transverse spread in energy that will enhance the performance of the free-electron laser technology.
31. A note on the construction of Numerov method through a quadratic continuous polynomial for the solution of general second order differential equation

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Abstract

This note presents a construction of Numerov method from a quadratic continuous polynomial solution (degree two continuous polynomial solutions). In contrast with [1, 3, 5] that was hitherto obtained from a degree four polynomial, the discrete Numerov method as a special case. This process lead to the block method applied to both initial and boundary value problem for the more general second order $y'' = f(x, y, y')$.

32. Construction of two-step block Simpson type method with large region of absolute stability

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Abstract

In this note, we describe the construction of two-step Block Simpson type method with non-uniform order, in continuous approximation form, with large regions of absolute stability. All the discrete schemes used in the block method come from a single continuous formulation. When used in block form, the suggested approach is self-starting, accurate and efficient. Numerical result is included to further justify our present method.
33. Optimal control of neutral systems with nonlinear base (The maximum principle perspective)

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Federal University of Technology, Owerri, Imo State
2Mathematics Department
University of Nigeria Nsukka, Enugu State

Abstract

In this paper we examine the Euclidean controllability for a neutral system with a nonlinear base given by

\[ \frac{d}{dt} D(t, x_t) = f\left[(t, x_t, u(t))\right] + B(t)u(t) \]

By a careful analysis of the maximum principle, necessary and sufficient conditions for the existence and uniqueness of optimal controls are deduced. This work is a great improvement of existing works providing a relationship between the attainable and reachable sets.

34. Constrained relative controllability of semilinear dynamical neutral systems with multiple delays in state and control.

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Abstract

In this work, we study the semilinear dimensional abstract control neutral system with multiple constant delays in the state and control given by

\[ \frac{d}{dt} \left[ x(t - h) \right] = \sum_{i=0}^{M} A_i x(t - h_i) + F(x(t)) + \sum_{i=0}^{M} B_i u(t - h_i) \]

with zero initial conditions \( x(0) = 0, u(t) = 0 \) for \( t \in [-h, 0] \)

where the state \( x(t) \) takes values in a real Banach space \( X \) and the control \( u(t) \) is in another real Banach space \( U \).
35. Newton’s equation of motion in the gravitational field of an oblate earth

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Abstract
In this paper, we derived Newton’s equation of motion for a satellite in the gravitational scalar field of a uniformly rotating, oblate spheroidal Earth using spheroidal coordinates. The resulting equation is solved for the corresponding precession and the result compared with similar ones.

36. Stability of triangular points in the generalised photogravitational restricted three-body problem with variable mass

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Abstract
The stability of triangular points under the influence of radiation pressure of the bigger primary, oblateness of the smaller primary and variation in mass of the third infinitesimal body has been investigated. It is found that these points are stable for $0 < \mu \leq \mu_c$ and unstable for $\mu \leq \mu \leq \frac{1}{2}$. It is also seen that the range of stability decreases due to radiation pressure, oblateness and variation in mass of the respective body.
37. Time dependent two phase flows in Magnetohydrodynamics: A Greens function approach

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Abstract

The present article presents a mathematical model to study the time dependent two phase magneto-hydrodynamic (MHD) flow in a parallel plat channel having one phase occupied by electrically conducting fluid and the other phase by non-conducting fluid. Both the phases were incompressible and the flow is assumed to be time dependent. The two regions are coupled by equating the velocity and shear stress at the interface. Using the Green’s function approach, expressions for velocity in both phases were obtained for general class of time dependent movement of boundary or sudden change in pressure gradient or both. As a special case, expressions for time dependent velocity fields in both phases were obtained due to sudden change in the pressure gradient.

38. Dynamic Analysis of a non-linear vibrating circular cylindrical shell using the regular perturbation technique

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Abstract

We investigated in this paper the effect of non-linear vibration of a circular cylindrical shell subject to axially symmetric loading. We consider the approximation of the equation using the regular perturbation technique and thereby solving the resulting linear equation analytically. The result indicates an exponential decay away from the edge of the shell, which is one of the unique characteristics of a shell. From the numerically simulated results it was observed that increase in the excitation amplitude produces a wrinkling effect on the shell.
39. Probabilistic dynamic stability of a damped spherical shell pressurized by a random load

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Abstract

This investigation examines the dynamic stability of a damped imperfect spherical shell within the precinct of a random dynamic load applied just after the initial time. The statistical characterizations of the random load, such as the mean and the autocorrelation, are assumed given and non-vanishing. In particular, the autocorrelation of the random dynamic load is a stationary noise that is correlated as an exponentially decaying harmonic function of time. Such stochastic and random characterizations of the dynamic load function confer some element of randomness on the normal displacement whose statistical mean we shall first seek for the determination of the dynamic buckling load. Lastly, the dynamic buckling load is determined via a suitable maximization and certain useful deductions are made. Assuming that the variance of the random load is $R_0$ and using the mean normal displacement as a relevant statistical characterization of the response, it is observed that the dynamic buckling load is of order 

$$R_0^{-1}, \text{ that is } O\left(\frac{1}{R_0}\right), \text{ of the load variance } R_0$$

40. On the static buckling of an externally pressurized finite circular cylindrical shell

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Abstract
The static buckling behaviour of an imperfect finite cylindrical shell, stressed by either a lateral or hydrostatic pressure, is here investigated by assuming that the imperfection can be regarded as the first term in the Fourier sine series expansion. The buckling modes are assumed to be in the shape of the imperfection which is in turn given in the shape of the classical buckling mode. Regular perturbation technique in asymptotic expansions of the relevant parameters is used and a simple expression for determining the static buckling load of the structure is determined. It is observed that, this procedure, perhaps more than other ones, can be used to analyze relatively more complicated problems particularly where more demands and restrictions are placed on the imperfection parameter. The result is strictly asymptotic.

42. On a two–small–parameter dynamic stability of a lightly damped spherical shell pressurized by a harmonic excitation

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Abstract

This paper is concerned with asymptotic solution, using multi-timing technique, of a nonlinear coupled elastic system in a dynamical setting where the structure investigated is a discretized imperfect spherical shell. The normal displacement at a point on the shell surface is assumed to be partly in the form of a symmetric pre-buckling mode, and partly in the form of buckling modes that have both axisymmetric and non-axisymmetric components. The geometric imperfection is assumed to be in the shape of the buckling modes. The explicitly time-dependent load function is assumed harmonic (or periodic) and the dynamic buckling load is obtained nontrivially with specializations of the results made. The results show, among other things, that (i) the only condition under which the effects of any coupling is felt is if none of the imperfections in the shapes of the modes coupling is neglected and (ii) neglecting an imperfection automatically nullifies the effects of the nonlinearity that is in the shape of the neglected imperfection.
42. On the impact of wave-current on Stokes waves

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Abstract

This study considers the impact of wave-current on Stokes waves in deep water. Using separately, the third, fourth and fifth order approximations of wave profile functions respectively and the determined expressions for wave-current speed, it is shown that the wave-current speed is more intense on the surface of the ocean, but however, the intensity reduces exponentially downwards with the depth. The present analysis also suggests that the wave-current speed increases with increase in wave steepness. It is further deduced that the wave-current speed is the same in magnitude for both fourth and fifth order; thus, showing the convergence of solutions concerning wave-current speed in Stokes waves as the order increases.

43. On the effects of wave steepness on higher order Stokes waves

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Abstract

The effect of wave steepness on higher order finite amplitude Stokes waves is investigated analytically and numerically. It is shown that the phase speed increases as the wave steepness increases thereby initiating the wave instabilities. As the order increases, the phase speed also increases. However, the impact of wave steepness on phase speed is more pronounced for the wave steepness parameter \( \varepsilon \geq 0.09 \), where \( 0.02 \leq \varepsilon \leq 0.33 \). Beyond the upper bound, instability-wave breaking comes in.
44. Effect of viscous damping on the response of a finite beam resting on a tensionless Pasternak Foundation subjected to a harmonic load

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Abstract

In this work we present results for the influence of viscous damping on the response of a finite beam resting on a Pasternak foundation using Galerkin weighted residual method. Results obtained show that the vibration amplitude reduces with increase in the damping term.

45. Geophysical investigation for ground water in Orifite, Anambra State, Nigeria.

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Abstract

Ten (10) vertical electrical soundings (fairly distributed over Orifite and its environs) were conducted using the Schlumberger array with six points per decade and current electrode spacing of 1-681m. The results of the Interpretation identified a perched aquifer belonging to Ogwashi-Asaba Formation and much closer to the ground surface (32-57m depth with apparent resistivities, 170-5595Ω\cdot m, and thicknesses, 71-146m) as the source of ground water to the borehole. Also, the result showed a second aquifer (the Nanka sand) at depth, 151-239m, and of resistivities, 574-6750 Ω\cdot m.
46. Geophysical study of the aquifer characteristics along River Niger, Delta State, Nigeria

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Abstract

Geophysical survey was carried out in order to study aquifer characteristics (such as the depth, thickness and nature of soil materials above it) in the major communities along River Nigeria. Schlumberger vertical electrical sounding was conducted at Anieze, Obeza, Asaba-Okpai, Akashakpu, Obobo-Oyibo, Okpai, Oluchi, Umu-Ugboma, Iyede-Ame, Umuti-Agboh and Aboh town. The resistivity soundings were carried out with half electrode spacing in the range 1-681m and six point per decade. The results were used to determine the depth, thickness of the recommended aquifer and the thickness of clay above it. The results showed a recommended aquifer of thicknesses, 14.40-68.75m at depths, 21.65-34.20m, and a clay of thicknesses, 0-10.80m above it.

46. Analytical determination of low velocity layer in 4-D hydrocarbon prospecting in parts of Imo State

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Abstract

Generally, Seismic reflection surveys are done in the oil sectors to determine commercially viable hydrocarbon reservoirs but in most cases reflection records are obscured by wave behaviours in weathering layer. Hence, Up-hole refraction surveys are carried out in 3-D and 4-D prospects with a view to delineating the accurate depth or location of hydrocarbon reservoirs with least distortion by
precise determination of the low velocity layer (LVL). Thus, Up-hole survey was done here using a 24-channel Seismograph OYO Mcseis 160mx which prints the seismometer responses from geological structures beneath in waveforms. These waveforms were studied and plotted to obtain the layer velocities of the waves and their corresponding layer thicknesses from fifteen randomly selected sites in the field. Analyses of results show that the field of study is basically a 3-layer zone in which the weathering layer thicknesses varied from 2.0m to 3.5m with velocity ranging from 340m/s to 1000m/s. The consolidated layer velocities range from 1750m/s to 2050m/s which fall within the range used for static correction on the reflection records. Thus weathering/static corrections here may be eliminated at about 3.0 m deep and at elevation of 20m to 40m above sea level in this field and similar fields.

47. Groundwater potential investigation using combined VLF and VES

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Abstract

This work is an assessment of groundwater in Oke-Agbe High School field located in Akoko North-West Local Government Area of Ondo State. The goal is to establish groundwater viability in this location based on a clear-cut relationship between Electrical Resistivity (VES) and Electromagnetics methods (VLF). Both methods were jointly used for investigation to determine overburden thickness, geo-electric layers and groundwater potential. The advantage of this combination is that the VLF technique was used as a reconnaissance survey to identify the best VES locations. The computer iterated data from the study area enabled us to delineate the area into high, medium and low water potential zones. Results obtained in this study clearly showed the depth to the bedrock beneath the VES stations. The field was contoured to demarcate areas with thick overburden (>10m), areas with medium overburden (between 5-8 m) and areas with relatively thin overburden (≤5m) marked as A, B, and C respectively. VES station 4 with infinite overburden thickness and VES station 6 with fractured basement are the only aquifer units within the entire school field where groundwater could be exploited and therefore, serve as high groundwater potential zones. However, it must be stated here that VES station 6 is the surest bet within the priority area for groundwater development. This result from combined technique is more reliable than the investigation based on only one method of investigation for groundwater feasibility studies, especially where the subsurface is doubtful.
48. Geophysical investigation of Oke-Agbe-Oyin Road failure using VLF and double dipole

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Abstract

The result of this paper is to establish a consistent approach to geophysical handling of road failure using electrical Resistivity method-Double Dipole and Electromagnetic method- VLF (Very Low Frequency). The work was done along Oke-Agbe Road in Ondo State. Computer iterated data from the study area enabled the delineation of the investigated portion of the road into highly weathered and non weathered zones with Resistivity values ranging from $37 - 595 \, \Omega \cdot m$. The form of road failure identified in this study is due to subsidence arising from differential settlements associated with clayey, fairly thick, geotechnical weak and low resistivity near surface horizon. The results obtained clearly demonstrates the relevance this kind of study in highway feasibility studies and roadway evaluation.

50. Fabrication and optical characterization of improved electroless chemically deposited strontium fluoride (SrF$_2$) thin films at 320K

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Abstract

Thin semiconductor films of strontium fluoride (SrF$_2$) were successfully deposited on glass microscope slides using simple and cheap electroless chemical bath deposition methods at 320K and pH values of 9, 10 and 12. Controlled addition of ethylenediamine tetra acetate (EDTA), another complexing agent with pH to oppose that of bath constitutions, was used to vary the deposition pH values. X-ray diffractometry technique was used to confirm the depositions. Absorbance spectra data of the films were obtained by a single beam spectrophotometer (Pharmacia LKB Biochrom 4060) at wavelength
range 200 to 900nm. Other optical and solid state properties were calculated from the data and compared with other deposited thin films. Average optical and solid state properties include absorbance ranging from 0.034 to 0.086, transmittance 0.820 to 0.925, reflectance 0.041 to 0.094, refractive index 1.51 to 1.88 absorption coefficient 0.078 to 0.198x 10^6 m^-1, electrical conductivity 0.40 to 0.49 (ohm cm)^1, film thickness 0.013 to 0.074μm and bandgap 2.55 to 2.75 eV. The deposited thin films could find applications in antireflection coatings for eyeglass, solar thermal control devices and solar cells.

51. Determination of the optical constants of a thin film supported on a thick transparent substrate

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Abstract

The full expression for the minima of transmission and reflection spectra of a thin absorbing film are unwieldy transcendental functions of wavelength. Exact solutions of these equations for optical constants are, therefore, not single valued but can be uniquely determined at the extrema of the spectra instead. The solutions require elaborate computer iteration procedures. For ease of computation, we derived the equation for the transmission minima and reflection maxima With Mathematica™, film constants N and K of a Ge_{28}As_{12}S_{60} thin film were then calculated by solving the nonlinear equations simultaneously. The solution converged for 1.5 < N < 24 and 0.0 < K < 0.5. Calculated values are at variance with published results by minkov [7] even with the same transmission and reflection data. The discrepancy arose from the r_m spectra. Interestingly, published values are in excellent agreement with straightforward calculation using another closed form equation by Swanepoel (1983) with only transmission data.
52. Analytical EAM alloy models for FCC metals.

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Abstract

An analytic electron density function ρ(r) and pair potential function ϕ(r) have been developed for FCC metals from their experimental binary alloy data. Values of the electron densities, derived from exact dilute limit heat of solution, were used to determine the pair potentials via the equation of state of Rose et al [3]. The parameters in the fitting functions have been calculated and tabulated in this study.

53. Analytic functions for calculating binary alloys of FCC metals

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Abstract

The problem studied in this paper is that of obtaining appropriate electron density function and a pair potential function for an FCC metal within the EAM format. The approach adopted is to use the experimental dilute limit heats of solution of the binary alloys of FCC metals as input parameters into Johnson analytical model, (Phys. Rev. B. Vol. 39 12554 (1989) [1]), for calculating the dilute limit heats of solution; and to try to determine the needed functions consistently. The functions that emerge from this approach satisfy the experimental information used as input and Johnson’s equation for this same quantity, but they do not support the assumption, often employed in literature, of a single exponentially decreasing function of r for these functions. This then constitutes our explanation for the hitherto observed discrepancy between theory and experiment. [See references 1 and 3].
54. Work function of elemental metals and its face dependence: Stabilized Jellium approach

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Abstract

The stabilizing potentials and work functions of elemental metals were calculated for the flat surface, the (111), (100) and (110) faces using the stabilized jellium model. The calculated work functions were compared with experimental values and calculated values obtained using the ab initio method. The stabilizing potentials for the different faces of the metals revealed that the less densely packed faces require higher potential for stabilization in the stabilized jellium model. The calculated work functions for the flat surface of the metals were in perfect agreement with experimental values for metals in the low-density limit and the agreement with experimental values decreased towards the high-density limit. The calculated work functions for the body centred cubic metals were in good agreement with experimental values. The calculated work function for the hexagonal close packed metals were in fairly good agreement with experimental values while the degree of agreement with experimental values was least for face centred cubic metals. The work functions of metals calculated in this work revealed that the more closely packed faces have higher work functions. The results obtained in this work revealed that the stabilized jellium model could be used to predict fairly well the work function of metals and calculate other metallic properties.

55. The effect of ammonia intercalation on the superconducting properties of the alkali-metal doped fulleride

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Abstract

The effect of ammonia intercalation on the superconducting properties of the alkali-metal doped fulleride...
A theoretical investigation of the electronic properties of the relatively high-$T_c$ alkali-metal doped superconducting fullerides when they are further exposed to ammonia molecules as dopants is presented. Our numerical method relies on a group theoretical technique for the formation of molecular orbitals (MO’s) for the solid $C_{60}$ using 60 radial atomic orbitals (AO’s) derived in a previous work. We also take into consideration the fact that the Fermi energies of the fullerides compare favourably with their phonon energies in the choice of a $T_c$ formula. The effect of the ammonia molecules, as intercalants, on the density of states at the Fermi level ($N(\varepsilon_f)$) and consequently superconductivity are then discussed.

56. Investigation of beta dielectric dispersion in Bovine yellow bone marrow tissue

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Abstract

The relative permittivity or dielectric constant, $\varepsilon'$ of bovine yellow bone marrow tissue has been investigated in this study at an average room temperature of $27.5 \pm 0.5^\circ C$ over a frequency range of $0.15\text{MHz}$ to $20\text{MHz}$ for $\beta$-dispersion using a resonance technique. This technique makes use of a Marconi magnification meter TF 1245 working in conjunction with a radio frequently oscillator TF 1246. In general the tissue exhibited a decrease in dielectric constant, $\varepsilon'$ with increase in frequency until a lower steady value was attained at high frequency.
57. Incremental cryptography and security of public hash functions

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Abstract

An investigation of incremental algorithms for cryptographic functions was initiated. The problem, for collision-free hashing, is to design a scheme for which there exists an efficient "update" algorithm: this algorithm is given the hash function \( H \), the hash \( h = H(M) \) of message \( M \) and the "replacement request" \((j, m)\), and outputs the hash \( H(M(j, m)) \) of the modified message. Ideally, the update time should depend only on the block size \( b \) and the underlying security parameter \( k \), and not on the length of the message.

58. Improving access, reliability and efficiency of a distributed operating system using replicated distributed object abstraction

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Abstract

This paper presents an alternative distributed operating system architecture based on the concept of replication of distributed objects. A complete or partial copy of distributed object's state is placed in each node where the object is used. Replication algorithms ensure copy coherence. For each object the most efficient access algorithm, taking its semantics into account, can be applied. This makes our proposed architecture a convenient platform for developing reliable distributed application.
59. Manpower Planning Model for Less Developed Countries

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Abstract

The need for manpower planning in underdeveloped countries is necessary to remove widespread unemployment and disguised unemployment in such economies. Models for predicting future manpower requirements are indispensable tools for planners and policy makers. A model which captures manpower demand and supply is developed in this study to predict future manpower structure in less developed countries (LDCs). In addition a partial adjustment to manpower planning model is proposed to off set the lag that may be present in manpower system.

60. Constructing an automorphism with discrete spectrum

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Abstract

This work is a desire to construct an automorphism with discrete spectrum using a numerical example. We briefly discuss how some of the definitions and theorems about its behaviour can be implemented and verified numerically. While it is not intended as a complete introduction to measure theory, only the definitions relevant to the discussion in this work are included. It went further to show that a necessary and sufficient condition for a measure-preserving transformation \( c \) on a unit circle \( S^1 \) to be invertible is that it must both be one-one and onto and concludes that it is an automorphism if the real number, \( \alpha \), is one.
61. Generalized biases in nonsymmetric univariate kernels

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Abstract

This work extends and generalizes biases in nonsymmetric kernels. The practice of obtaining biases of any nonsymmetric kernel when the order of the smoothing parameter, h, is one is seen not to be sufficient as the error size for this case is large. A new scheme for higher order biases in nonsymmetric univariate kernels is proposed. This scheme enjoys not only the possibility of reducing the size of the global error term (MISE), but also generalizes the bias term for any nonsymmetric kernels.

62. The ground state of the Hubbard model

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Abstract

The Hubbard Hamiltonian was diagonalized using Valatin-Bogojiubov transformations. The following results were obtained:

\[
U_i^2 = \frac{(\varsigma_i^2 - 2\Delta_i^2)}{2(\varsigma_i^2 - \Delta_i^2)} \pm \sqrt{\frac{(2\Delta_i^2 - \varsigma_i^2)^2 + 4(\varsigma_i^2 - \Delta_i^2)(\Delta_i^2)}{4(\varsigma_i^2 - 2\Delta_i^2)}}
\]

\[
V_i^2 = 1 - U_i^2
\]

\(V_i\) and \(U_i\) are numbers defined for positive values of \(i\). The energy of the quasiparticle vacuum was found to be
\[ E_0 = \sum_{i} \left( \langle i | j \rangle - \lambda \right) \nu_i + U \sum_{i} \nu_i^4 \]

And the number of particles in the ground state was found to be \( N_0 \)

\[ N_0 = \sum_i \left\{ 1 - \frac{\left( \sigma_i^2 - 2 \Delta_i^2 \right)}{2 \sigma_i^2 - \Delta_i^2} \pm \sqrt{\frac{\left( \sigma_i^2 - \Delta_i^2 \right)^2 + 4 \left( \sigma_i^2 - \Delta_i^2 \right) \Delta_i^2}{2 \left( \sigma_i^2 - \Delta_i^2 \right)}} \right\} \]

where \( \sigma_i = (\lambda - t_i) \), \( \Delta_i = -\mathbf{\Sigma}_i U_i V_i \), \( t \) is the hopping parameter, \( U \) is the on-site interaction, \( \lambda \) is the Lagrange multiplier.

63. Testing Mulliken approximation using hydrogen atom

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Abstract

We computed the ground state energy of the hydrogen atom within the semi-empirical method prescribed by Mulliken. The one-particle basis functions used are Slater-type-orbitals (STO). The exponential parameters terminated at 25. The more the basis set used in the calculation, the better the result, in agreement with standard electronic-structure calculations. The density matrix for the free electron gas at zero temperature was adopted (Xiaoding Zhang and D. A. Drabold. Phys. Rev. B63, 233109 (2001 [10])).
64. Embedded atom method for materials with a negative Cauchy discrepancy

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Abstract
An earlier suggested generalized embedding function by Oni-Ojo et al [J. Nig. Ass. Math. Phys. Vol. 9, 507 (2005) [2]] is here utilized to set up an embedded – atom method (EAM) for materials with a negative Cauchy discrepancy. To be able to do this it was found necessary to drop the usual assumptions that the curvature of the embedding function must be positive definite, while its slope must be negative. Concrete results are provided for the material strontium (Sr).

65. Further results on the classes of convex functions

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Abstract
This paper presents more results on the classes of convex sets and functions. The results are follow-up to similar results obtained on the classes of convex sets and functions by [1] and [9]. These relationships were further shown among convex sets which were not considered in the above references and more results were proposed and proved.
66. Certain inequalities and convolution properties for multivalent and meromorphically multivalent functions

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Abstract

By means of certain extended derivative operator of Salagean type, the author introduces and investigates three new subclasses of p-valently analytic functions. The reason for this is to use generalized Salagean derivative operator to bring together many earlier introduced subclasses of p-valently functions to become special cases of the newly defined subclasses, see [2,8]. The various results obtain for these functions include coefficient inequalities, coefficient bounds and convolution properties. These results coincides with many existing results using different choices of n and β.

67. Hamilton-Jacobi-Bellman equations for quantum control

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Abstract
The aim of this work is to study Hamilton-Jacobi-Bellman equation for quantum control driven by quantum noises. These noises are annihilation, creation and gauge processes. We shall consider the solutions of Hamilton-Jacobi-Bellman equation via the Hamiltonian system measurable in time.

68. Solving microwave heating model in a slab using shooting technique

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Abstract

We employ shooting technique to explicitly construct the approximate solution of steady state reaction–diffusion equations with source term that arise in modeling microwave heating in an infinite slab with isothermal walls. In particular, we consider the case where the source term decreases spatially and increases with temperature. The important properties of the temperature fields and thermal criticality are discussed.
69. Heat and mass transfer in the unsteady hydromagnetic free-convection flow in a rotating binary fluid I

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Abstract

The paper studies the unsteady free-convection flow near a moving infinite flat plate in a rotating binary mixture of an incompressible fluid. Both Soret (thermal diffusion), Dufour (diffusion-thermo) and radiation effects are considered when there is no chemical reaction. By imposing a time dependent perturbation on the constant plate temperature and concentration and assuming a differential approximation for the radiative flux, the coupled nonlinear problem is solved for the temperature and the concentration. First a critical value for the Soret was determined as 0.10 and the effects of Dufour, Soret and radiation show that while both Dufour and Soret have no effect on the temperature field, they both affect the concentration field with the Dufour causing an overwhelming increase and the Soret just a slight decrease. Furthermore radiation decreases both the temperature and concentration field.

70. Influence of power-law index on an unsteady exothermic reaction

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Abstract
This study presents the solution of an unsteady Arrhenius exothermic reaction where we reduced the exponential term to a power-law approximation. A numerical solution of the problem is obtained using shooting technique with second order Runge-Kutta scheme. It is shown that the temperature of the reactant depends on the power-law index. The temperature of the reactant increases as the power-law index increases.

71. Second law analysis of a reacting temperature dependent viscous flow through an inclined channel with isothermal walls.

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Abstract

In this paper, entropy generation during the flow of a reacting viscous fluid through an inclined channel with isothermal walls are investigated. The coupled energy and momentum equations were solved numerically. Previous results in literature (Adesanya et al 2006 [17]) showed both velocity and temperature have two solutions. We compute the entropy generation for each set of solutions. Tables and figures feature prominently.
72. Pressure on the Cochlea as a Load on the basilar membrane: Its contribution to the mechanism of hearing

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Abstract

A Mathematical model of the pressure equation was obtained and solved to show the effect of pressure as a load on the basilar membrane deformation (motion) and that the basilar membrane motion is in opposite direction to pressure (load) application on it. This means that when pressure is exerted on the basilar membrane, it pushes it down and vice versa. This movement of the basilar membrane also results in the movement of the Oval and Round windows which also move in opposite direction relative to the one another as well as to the load exerted on the basilar membrane. As expected, it was seen that the pressure difference at any point inside the cochlea and thus the basilar membrane is a function of the location of interest since x₁ and x₃ are implicated in the expression for the pressure difference.

73. Euclidean null controllability of perturbed infinite delay systems with limited control

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Abstract
Sufficient conditions for the Euclidean null controllability of perturbed infinite delay systems with limited control are developed. The results are established by placing conditions on the perturbation function which guarantee that, if the linear control base system is completely Euclidean controllable, then the perturbed system is Euclidean null controllable with limited control.

**Keywords:** Controllability, delay systems, perturbation, Euclidean null controllability, properness.

### 74. A mathematical model for the interception of a moving target: contribution to optimal controllability theory

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**Abstract**

In this study, a mathematical model for the interception of a target governed by a linear ordinary control system is derived. The condition for interception is stated. The interception criterion is the intersection of certain well defined set functions. The equivalent of the condition is controllability of the linear control system. This research has made its modest contribution to mathematical modeling as well as provided example of an optimal control problem.

**Keywords:** Attainable set, Reachable set, target set, compact set function, controllability.

### 75. Mathematical modelling of uniform flow in three open channels
Abstract

The sole aim of this work is to develop a mathematical model for dredging (excavating) three open channel sections, namely, the circular, parabolic and trapezoidal sections using the conditions for best hydraulic performance for the channels. Applying the model to a numerical example, new dimensions of the new channel for the three channel sections are determined and compared with the original ones, if the cross sectional area, bed slope and Manning’s friction factor remain unchanged for each channel and if the side slopes are also stable with respect to the trapezoidal channel. Furthermore, a combination of our model with Darcy’s formula can provide an alternative method for comparing the hydraulic performances of the three channel sections.

76. Vertical electric sounding investigation of aquifers in the Ekpoma area of Nigeria.

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Abstract

Aquifers or water bearing formations existence was investigated in Eguare-Egoro, Ekpoma, Edo State, Nigeria by using vertical electric sounding (VES) of schlumberger array. The array was employed with minimum drilling spread of 2m and maximum spread of 500m. The need to investigate aquifer existence in Eguare-Egoro becomes inevitable because of acute shortage of water in the area. The acute shortage of water in the area is primarily due to its unfavourable climate
and geology that made the aquifer level to be very deep. This great depth often leads to borehole failure considering the great pumping distance of the machine. Interpretation of data was done initially by curve which provided computer iterative model. The results obtained were presented in the form of geoelectric sections which was then interpreted using bore-hole log as a control to detect various lithologies encountered and aquifers existence in the area. The aquifers are probably sands, clays, sandstones and or sands with clay intercalation. The resistivity values for the existed aquifers detected vary from 40 ohm-m to 12,000 ohm-m.

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77. Capacity and coverage of power controlled CDMA cellular systems

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Abstract

Coverage and capacity are among the ambitious challenges to be met by the third generation (3G) systems for successful deployment of its services to both residential and commercial subscribers. This paper reports on the performance study of CDMA systems in relation to an optimum step-regulated SNR-based transmitted power. We derive the system model and present a computer simulation to optimize the transmitted power for each user and maintain the required \( \frac{\lambda_b}{N_0} \) (signal-to-noise ratio) for satisfactory call quality by achieving a minimal \( \frac{\lambda_b}{N_0} \) for every user with an acceptable channel performance. We observe from the simulation that SNR based power control with updating step-size of 0.8dB provides acceptable system availability and stability.

Keywords: CDMA, QoS, transmit power control, optimization, signal-to-noise ratio.
78. Initial and final estimates of the Bilinear seasonal time series model

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Abstract

A particular class of non-linear models which has been found to be useful in many fields is the bilinear models. A special class of it is discussed in this paper. In getting the estimates of the parameters of this model special attention was paid to the problem of having good initial estimates as it is proposed that with good initial values of the parameters the estimates obtaining by the Newton-Raphson iterative technique usually not only converge but also are good estimates. In this paper we examined the initial and final estimates of the bilinear seasonal time series model. The Box-Jenkins linear convergence process, the Newton-Raphson iterative procedure, the Fortran Program and the MINITAB software package were all employed in achieving both the initial estimates and the final estimates of the bilinear seasonal time series model studied. The results showed considerable closeness between the initial estimates and the final estimates for both simulations (n = 100 and n = 500). This confirmed that the initial estimates are good enough. The implication of this is that in estimations of this nature efforts should be made using the right procedures to achieve good initial estimates so that the final estimates could be achieved quickly after few iterations.

Keywords: Bilinear seasonal models, Box and Jenkins linear convergence process, Newton-Raphson iterative procedure, Initial estimates, Final estimates

79. Identification of the time series interrelationships with reference to dynamic regression models
Abstract

In this study, the model of interest is that of a rational distributed lag function $Y$ on $X$ plus an independent Autoregressive Moving Average (ARMA) model. To investigate the model structure relating $X$ and $Y$ we considered the inverse cross correlation function for the observed and residual series in the presence of outliers. A two stage identification procedure is presented which involves fitting univariate time series model to each series and identifying a dynamic shock model relating the two univariate model series. The models so far obtained were combined to identify a dynamic regression model, which were fitted in the usual ways. From our findings, there was a reduction in the error variance of the final model with the outlier free stationary series which is an indication that the two-stage procedure is reliable and efficient.

Keywords: dynamic shock model, inverse cross correlation, rational distributed lag function, outliers, dynamic regression model.

80. Contributions of influence function using the inverse autocorrelation function in the detection of outliers

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Abstract

Outliers in time series, depending on their nature may have a moderate to significant impact on the effectiveness of the standard methodology for time series analysis with respect to model identification, estimation
and forecasting. The suggested procedure used for identifying the outliers graphically in time series data was investigated by considering the influence function for the inverse autocorrelation function (IACF). From the findings, it was noticed that for large series the influence was almost positive in values while for relatively short series the large negative influence are noticeable. The model order determination technique was also proposed.

**Keywords:** outliers; inverse autocorrelation function; influence function; order determination


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**Abstract**

The measurement of air aerosol size during the 2001/2002 harmattan season at Uturu, Nigeria is of interest. Aerosol size distributions were measured making use of a zeiss micrometer which is inserted on the diaphragm inside the eyepiece of Olympus binocular microscope. Dust samples collected by direct deposition within the months of October 2001 to February 2002 on a Whatman filter paper made of cellulose were placed on a glass slide and viewed under a microscope. The mean value of the measured aerosol diameter and the standard deviation is 2.74 ± 1.7 \( \mu m \). The mean of the calculated surface area distribution of the aerosols is 38.33 ± 9.3 square \( \mu m \).

**Keywords:** aerosol size; aerosol surface area; zeiss micrometer; microscope.
82. Age-pattern of blindness in Nigeria

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Abstract

This paper discusses age pattern of blindness in Nigerian. The ultimate objective is to provide information on which strategies for prevention and treatment of blindness, as well as the rehabilitation on which strategies for prevention and treatment of blindness, as well as the rehabilitation and integration of blind persons into social life could be based. This follows from the fact that most causes, preventive measures and treatment of blindness have been found to be associated with age. Secondary data drawn from the 1994 census of the Federal Republic of Nigeria was analysed using the methods of categorical data and regression analyses. Results show that the quality of data on age and sex on the blind population is very poor. From the census data the level of prevalence of blindness in Nigeria was shown to be grossly under-reported. It was also found that third degree polynomial appears to describe the age-pattern of blindness in Nigeria, though not adequately. The inadequacies were attributed to the distortions in the age reporting. Until further research proves otherwise, estimates of the age-specific prevalence of blindness based on the third degree polynomial has been recommended for use in developing strategies for addressing problems of blindness in Nigeria among others.

Keywords/expression: Blindness, prevalence, disability, age-pattern, visual impairment.