BOOK OF ABSTRACTS

4TH ANNUAL WORKSHOP AND CONFERENCE

OF THE

NIGERIAN SOCIETY FOR MATHEMATICAL BIOLOGY (NSMB)

Theme:
Sustaining health and bio-medical reforms in Nigeria through Mathematics

Date: 8TH - 14TH SEPTEMBER, 2019

Venue : Department of Mathematics
Faculty of Physical Sciences
University of Nigeria, Nsukka

Programme of Events

Day 1 - 3: Monday, 9th - Wednesday, 11th September 2019

Time	Event
7am	Workshop on Mathematical modelling and simulations
5pm	Arrival/Registration for conference at the Department of Maths, UNN Prof J. O. C. Ezeilo (aka Abuja) Building

Day 4: Thursday 12th September 2019

Time		Event
8am	-	Breakfast/Regisration
	-	at the Department of Maths, UNN
	-	Prof J. O. C. Ezeilo (aka Abuja) Building
9.00am	-	Arrival of participant, guest and dignitaries
	-	to the Conference opening ceremony
10am	-	Conference opening ceremony commences
	-	at Faculty of Physical Sciences Lecture Theatre
10am	-	Introduction of Guests
10.10am	-	National Anthem
10.15am	-	Opening prayer
10.20am	-	Welcoming Address by **Prof U. C. Okoro**
	-	Dean, Faculty of Physical Sciences, UNN
10.30am	-	NSMB, President Address
	-	**Prof. G. C. E. Mbah**
10.30am	-	Address by the Head, Department of Mathematics, UNN
	-	**Dr. A. O. Odio**
10.40am	-	Address by the Chief Host and Declaration of the Conference open
	-	**Prof C. A. Igwe**
	-	Vice Chancellor
	-	University of Nigeria Nsukka
11.40am	-	Good will messages from other invited guests
11.50am	-	Closing Remark and Vote of Thanks
	-	**Prof G. C. E. Mbah (LOC Chairman)**
11.55am	-	Closing prayer
12.00noon	-	National Anthem
12.05pm	-	Group photographs
12.45pm - 01.25pm	-	Plenary lecture 1:Modelling Challenges when Dealing Vector-Borne Diseases: The Case of Mosquito-Borne Infections **Prof. Daniel Okuonghae,** University of Benin, Benin City, Nigeria.
01.30pm - 02.10pm	-	Plenary lecture 2: **Prof G. C. E Mbah**
02.10pm	-	Lunch Break
03.00pm	-	Parallel Session 1
06.00pm	-	Dinner
07.00pm	-	Closing for the day

Day 5: Friday 13th September, 2019

Time	Event	
8.00am	-	Breakfast
9.00am	-	Parallel Sessions 2
11.20am	-	Parallel sessions 3
01.00pm	-	Lunch break
02.00pm	-	Parallel session 4
05.00pm	-	AGM
07.00pm	-	Conference Dinner
08.00pm	-	Closing

Saturday 14th September, 2019

Time	Event
	Departure

Contents

Part I

Contributed Talks

A: Epidemiological Models

A1: MODELLING THE EFFECTS OF MALARIA ON GENES

ABDURRAHMAN OLAMIDE NURAT, AKINWANDE NINUOLA and ABU SOMMA SAMUEL
Department of Mathematics, Federal University of Technology Minna, Niger State, Nigeria

Abstract

This paper models the effects of malaria on genes using a first order differential equations. Incorporating the sickle cell class and the carrier class of mosquito. The Disease free equilibrium was obtained and the reproduction number was also obtained. The local stability of DFE was analyzed an it is stable if . The reproduction number was presented graphically.

Keywords: genes, carrier, Diseases Free Equilibrium, Reproduction number.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A2: MATHEMATICAL ANALYSIS OF TRANSFUSION TRANSMITTED MALARIA MODEL WITH OPTIMAL CONTROL

Adeniyi M.O[1*], Aderele O.R[2], Amalare A.A[3]
Department of Mathematics and Statistics, School of Pure and Applied Sciences, Lagos State Polytechnic, Ikorodu Lagos State, Nigeria
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Abstract

An SIRS (Susceptible Infected Removed-Susceptible) mathematical model for the transmission dynamics of Transfusion Transmitted Malaria (TTM) model with optimal control pair and is developed and studied in this research work. The model exhibited two equilibriums; disease-free and endemic equilibrium. It is shown that the disease free equilibrium is locally asymptotically stable if the associated basic reproduction number is less than unity while the disease persists if is greater than unity. The global stability of the Transfusion Transmitted Malaria model at the disease free equilibrium is established using the comparison method. The optimality system is derived and an optimal control model of blood screening and drug treatment for the Transfusion Transmitted Malaria model is investigated. Conditions for the optimal control were considered using Pontryagins Maximum Principle and solved numerically using the Forward and Backward Finite Difference Method (FBDM). Numerical results obtained are in perfect agreement with our analytical results.

Key words: Malaria, Transfusion-Transmitted, Basic Reproduction number, Stability, Equilibrium, Optimal Control

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A3: On the Mathematical Model of a Rarely Outbreak of Ebola Virus

[1]James Andrawus and [2]Sirajo Abdulrahman
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Abstract

A mathematical model of Ebola transmission dynamics was developed and analyzed, it was discovered that effective treatment for isolated cases and natural recovery of latently infected will reduce the burden of EBV in the population and also the Results showed that as long as the other agents exist, there will be rarely outbreak of the disease with devastating deleterious impact on the society except with control response of vaccine, quarantine and isolation of infected individuals.

Keywords: Ebola virus disease, Isolated individuals, Mathematical model and Rarely outbreak

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A4:KINETIC MODELLING OF THE INCUBATION TIME (PERIOD) TO MANIFESTATION OF DISEASE (TYPHOID FEVER AS A CASE STUDY)

Obarakpor Irikefe Kingsley, Vivian Ifeoma Okoriguo and Gobe Felix Okiemute
School of Science and Technology Delta State School of Marine Technology, Burutu, Delta State Nigeria

Abstract

Illnesses do not just manifest the moment an individual ingest a pathogen; it takes sometimes before the diseases symptoms start to manifest. This time called the incubation periods, determine the extent of the spread of an infectious agent. Diseases with typically long incubation periods can spread extensively before the first cases appear. The long incubation period of the disease causative agent allowed widespread dissemination of the organisms by the individual that first picked up the organism. The disease can only manifest itself as illness after the organism has reach certain critical concentration in the infected person. So the periods from the moment the individual picked up the organism to the time it reaches the critical concentration when illness appears can be evaluated using kinetic. The paper is purely theoretical and relies purely on secondary data.

Keywords: Illnesses, Pathogen, Disease, Symptoms, Incubation, Organisms, and Kinetics

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A5: Mathematical Model For The Transmission And Control Of Zika Virus Fever Dynamics In Enzootic Region

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Abstract

Overview of the dynamic transmission and control of zika virus fever is given and a mathematical model of the infection in enzootic region is formulated. The model improved on the existing model in Adeyemo et al. (2018) by incorporating human and non human hosts of the virus in order to adequately accommodate the necessary dynamics of zika virus fever in the enzootic environment; moreover vaccine is also introduced into the model. The formulated mathematical model is examined and confirmed to be epidemiologically well posed and suitable for further mathematical analysis.

Keywords: Zika Virus; Zika Virus Fever; Mathematical Model; Enzootic Region; Host; Vaccine

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A6: Analytical Solution of Cholera Model Using Homotopy Perturbation Method (HPM) : A Direct Mode of Transmission Approach

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Abstract

In this paper we discussed biologically and formulated a mathematical model for the control of cholera disease, considering only the direct mode of transmission approach . The model solutions were solved analytically using Homotopy perturbation method (HPM). The total population N was grouped into four compartments and the local stability of a disease free equilibrium and an endemic equilibrium were analysed .The basic reproduction number R_0 calculated using next generation matrix method (NGMM) was found to be stable for $R_0 < 1$ and unstable $R_0 > 1$

Keywords: cholera model, biology, homotopy perturbation, direct mode, basic reproduction number

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A7: SEMI-ANALYITCAL METHODS FOR A MATHEMATICAL MODEL ON AVIAN INFLUENZA

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Abstract

In this paper, we adopt the Variational Iteration Method (VIM) and the Differential Transform Method (DTM) as algorithms to approximate the solution of the model of the transmission dynamics of avian influenza formulated and analysed by Kimbir et al. [1]. Since the exact solution is not handy, we assume that the solution computed by the fourth-order Runge-Kutta method (RK4) is accurate. We chose the conventional RK4 as our benchmark, as it is widely accepted and used. Sensitivity analysis was also carried out on the control basic reproduction number, R_o with respect to the model parameters.

Keywords: Avian influenza model, Variational Iteration Method, Lagrange multiplier, Differential Transform Method, sensitivity analysis.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A8: Mathematical and Biological Analyses of Neisseria Gonorrhea Disease Model: A Disease Free Equilibrium Approach

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Abstract

Gonorrhea is a sexually transmitted infection caused by bacterium Neisseria gonorrhea. Today, this life threatening infectious disease is a great challenge to the society. In this article, we developed treatment epidemic model for Nesseria gonorrhea disease in order to gain insight into the transmission dynamics and understand epidemic situation and suggest control measures. We analyzed Local stability of the model and the basic reproduction number R_0 using next generation matrix method (NGMM). The disease free equilibrium was determined to be locally asymptotically stable for $R_0 < 1$ and unstable for $R_0 > 1$. The numeral simulation was investigated to enable us visualise the effects of some sensitive parameters and the results reveal that improved treatment, high quality sanitary healthcare eradicate spread of gonorrhea in the population.

Key words: Neisseria ghonorrhea, biology, endemic equilibrium, treatment, vaccination, basic reproduction.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A9: On the Mathematical Analysis of Lassa fever model on age differences and multiple rodent reservoir

Ifeanyi Sunday Onah, Madueme Praise-God U.
Department of Mathematics, University of Nigeria, Nsukka

Abstract

Lassa fever, continue to pose severe threat to life in developing countries, especially Nigeria, where outbreaks occur and are intensely interconnected with poverty and poor sanitation. In this study, we formulated a Lassa fever disease model that comprises humans with different age varieties that are exposed to different rodent reservoir. We considered some mathematical features in studying this model, like the basic reproduction number, outbreak growth rate, and type reproduction number. The global stability of the DFE was investigated and performed, so also the local stability of the endemic equilibrium was investigated. We proceeded in carrying out numerical simulations to concretize our analytical solutions of the model.

Keywords: Age differences, multiple reservoir, stability, basic reproduction number, simulations.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A10: Deterministic Modeling to Determine the Current Intervention and Possibly Other Modalities for HIV/AIDS

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Abstract

Literature abound about the negative effects of the late detection of the Human Immuno-Deficiency Virus (HIV) on the effective screening and treatment of infected persons resulting in high number of mortality cases. For this study, Deterministic models to determine the effect of HIV screening at the symptomatic stage as HIV intervention was developed and evaluated. Result showed that HIV screening stationed at the hospital for HIV individuals at the symptomatic stage have the potential of reducing mortality due to AIDS, the higher the number of individuals detected in the symptomatic stage, the lower the mortality due to the infection. Based on this, early intervention where the HIV screening is taken out in search of those who have the infection and are at asymptomatic stage of the infection, may lead to reduced mortality due to the disease and its morbidity.

Keywords: HIV/AIDS, HIV Screening, HIV Symptomatic, HIV asymptomatic, Deterministic modeling
Classification: Epidemiology

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A11: Transmission Dynamics of Hepatitis C Virus Infection with Asymptomatic Carriers Using Optimal Control Analysis

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Abstract

In this paper, we present the transmission dynamics of the acute and chronic hepatitis C virus (HCV) epidemic problem and develop an optimal control strategy to control the spread of disease. In order to control the spread of the virus, we develop a control strategy by applying three control variables such as vaccination, treatment of acute infection and treatment of chronically infection to minimize the number of acute infected, chronically infected with HCV individuals and maximize the number of susceptible and recovered individuals. We find the necessary conditions for the optimal solution for controlling the spread of the virus using Pontryagins Maximum Principle (PMP). Runge-Kutta of order four was used for the numerical simulation to demonstrate the achievability of the control strategy.

Keywords: Transmission, Optimal control, Susceptible, Runge-kutta, Maximum principle

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A12: A MATHEMATICAL MODEL ON THE TRANSMISSION DYNAMICS AND CONTROL OF LASSA FEVER

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[2]Department of Mathematics, Federal University Birnin Kebbi, Kebbi State, Nigeria.

Abstract

In this paper, a mathematical model on the transmission dynamics and control of Lassa fever was developed and analyzed. We considered three interacting populations of humans, rodents and virus in the environment. The human population is divided into six compartments including the compartment of individuals that recovered with complications. And the rodent population is partitioned into three compartments. Existence of disease-free and endemic equilibriums was established. Using the next generation operator approach we find the effective reproduction number which signifies local asymptotic stability of the disease-free equilibrium whenever is less than unity. Using Lyapunov theorem we further established the global asymptotical stability of the disease free equilibrium whenever .

Keywords: Lassa fever, rodents, virus in the environment.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A13: SENSITIVITY ANALYSIS OF A MATHEMATICAL MODEL FOR THE DYNAMICS OF DIABETES MELLITUS AND ITS COMPLICATIONS INCORPORATING CONTROL

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Abstract

In this paper, a mathematical model for the dynamics of diabetes mellitus and its complications incorporating control was developed. The population under study were divided into healthy, susceptible, diabetic without complication, diabetic with complication, diabetic with complications undergoing treatment. We obtained the disease persistent state and carried out Eigenvalue Elasticity and Sensitivity analysis of the model parameters. The result shows that ,which is mortality rate due to complications has the greatest impact on the model performance.

Keyword: Diabetes mellitus, Complications, Diease persistent state, Eigenvalue Elasticity analysis, Eigenvalue Sensitity analysis.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A14: STRATEGIC MALARIA CONTROL: A MATHEMATICAL MODEL

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5Department of Mathematics, University of Jos, Nigeria

Abstract

Many interventions have been done to reduce malaria transmission. Situation is not entirely positive, despite the above assertion. Millions of lives have been claimed as a result of malaria. This work is an extension of the malaria model by [Maliki et al 2018]. We considered potential impact of LLIN, treatment compliance, indoor residual spraying as well as pond water control in eradication of malaria. we obtain disease free equilibrium and basic reproduction ratio using next generation matrix. Conditions for the eradication of the disease were determined. Numerical simulation was carried out using Runge- Kutta order four. These strategies played crucial role in salvaging the number of infected individuals. Result shows that malaria transmission could be reduced whenever these control measures are applied effectively.

Key words: Malaria Control, Infected Immigrants, Basic Reproduction Ratio, MATLAB Simulation

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A15: A DELAY DIFFERENTIAL EQUATION MODEL OF HEPATITIS B VIRUS (HBV) INFECTION AND IMMUNE CONTROL

Titus Ifeanyi Chinebu1, Edmund Onwubiko Ezennorom2 , Godwin C.E. Mbah3

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Abstract

we investigated the intracellular delay effect on the stability of the endemically infected steady state by analyzing a nonlinear ordinary differential equation model of hepatitis B virus (HBV) infection that considers the interaction betweena replicating virus, hepatocytes and the cytotoxic T lymphocytes (CTL). We gave a criteria to ensure that the infected steady state is asymptotically stable for all delays. A critical delay below which the CTL (immune control mechanism) can be significantly helpful in controlling the HBV infection even when the basic reproduction number is high is allowed in the analysis.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A16: FORMULATION OF A MATHEMATICAL MODEL OF XYLELLA FASTIDIOSA TRANSMISSION DYNAMICS WITH CONTROL

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Abstract

In this paper, we formulated a mathematical model of Xylella fastidiosa transmission dynamics with control. The model comprises of two different populations of plants and vectors with 8 variables. Disease transmission between plants and insects as well as between plants and plants are incorporated. Existence and uniqueness of the model was carried out and it shows that the solution exist and it is unique.

Keywords: Mathematical model, Xylella fastidiosa and vectors.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A17: MATHEMATICAL ANALYSIS OF THE IMPACTS OF QUARANTINE AND ISOLATION ON LASSA FEVER TRANSMISSION DYNAMICS

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Abstract

In this paper, an extended mathematical model of Lassa fever disease transmission dynamics incorporating quarantine and isolation controls was presented. The disease-free and endemic equilibrium points were established. The effective reproduction number of the model was obtained. By constructing a suitable Lyapunov functional, the global stability of the disease endemic equilibrium of the model was obtained for . It was shown that if , then the model has a unique endemic equilibrium, which is locally asymptotically stable. Our analysis demonstrate that effective rate of quarantining people who have been in contact with an infected individual by a quarantine programme for close observation and progression rate of exposed to quarantined will have a positive impact in reducing the burden of Lassa fever in the population. The mathematical relations established in this paper show how quarantine and isolation can be exploited to provide effective control of Lassa fever in a population.

Keywords: Lassa fever, Modeling, quarantine and isolation controls, stability analysis

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A18: Modelling Vertical Transmission of Hepatitis B Virus and the Effect of Treatment in an Age-Structured Population

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Abstract

An age-structured SIR compartmental model of Hepatitis B Virus dynamics that incorporates vertical transmission and the effect of Treatment is developed. The model equations were first transformed into proportions, thus reducing the model equations from eight to six differential equations. The model is analyzed for the existence and stability of the disease-free equilibrium (DFE) state. We established that a disease-free equilibrium state exists and is locally asymptotically stable when the basic reproduction number $R_0 < 1$ and the following threshold conditions ($R_1 < 1, R_2 < 1, R_3 < 1, R_4 < 1, R_5 < 1, R_6 < 1, R_7 < 1 and R_8 < 1$) are satisfied. This invariably is biologically interpreted to mean that eradication of the disease is possible in finite time under these conditions. Furthermore, the model was solved numerically using Runge-Kutta Fehlberg method of order four and numerical simulations carried out yields interesting results. Results in this paper suggest that high treatment rate should not be done in isolation; rather it should be combined with behavioral interventions which will reduce the prevalence of the infection. Mother to child (MTC) transmission of the disease can be reduced to the barest minimum if the probability of transmission from adult to adult and mother to child is significantly reduced to zero. To achieve this, education and counselling of both susceptible and infected juvenile and adults will go a long way to reduce the probability of transmission to the barest minimum. Finally, susceptible children must also be assisted to retain their current status via continuous counselling and education as the mature to susceptible adult at the rate of η_s.

Keywords: Mathematical modeling, Basic Reproduction number. Stability analysis, vertical transmission, age-structured population

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A19: DETERMINSTIC MODELING OF EFFECT OF HIV SCREENING AS INTERVENTION FOR HIV/AIDS

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Abstract

Literature abound about the negative effects of the late detection of the Human Immuno-Deficiency Virus (HIV) on the effective screening and treatment of infected persons resulting in high number of mortality cases. For this study, Deterministic models to determine the effect of HIV screening at the symptomatic stage as HIV intervention was developed and evaluated. Result showed that HIV screening stationed at the hospital for HIV individuals at the symptomatic stage have the potential of reducing mortality due to AIDS, the higher the number of individuals detected in the symptomatic stage, the lower the mortality due to the infection. Based on this, early intervention where the HIV screening is taken out in search of those who have the infection and are at asymptomatic stage of the infection, may lead to reduced mortality due to the disease and its morbidity.

Keywords: HIV/AIDS, HIV Screening, HIV Symptomatic, HIV asymptomatic, Deterministic modeling

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A20: Mathematical Analysis of a Model of Two Strains of Typhoid Fever Disease with Optimal Control

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Abstract

A novel deterministic mathematical model for two strains of Typhoid Fever with optimal control is designed and analyzed to assess the impact of time dependent control strategies (namely, prevention and treatment strategies) on the dynamics of drug-sensitive and drug-resistant strains of Typhoid fever disease. Numerical simulations of the model suggest the best control strategy in eradicating both strains of the disease in a population where the two strains are co-existing. Keywords: Typhoid Fever, Drug-sensitive strain, Drug-resistant strain, Optimal Con- trol, Reproduction number.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A21: Analysis of a co-infection model for HPV-TB

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Abstract

A two-sex, co-infection model for the transmission dynamics of Human papillomavirus (HPV) and Tuberculosis (TB) in a population is developed and analyzed to gain insight into the impact of the spread of each of the two diseases in a population. The HPV-only sub-model (with heterosexual transmission route only) undergoes the phenomenon of backward bifurcation when the associated reproduction number of the HPV-only sub-model (denoted by $R_{0H}|\epsilon_F = \epsilon_M = 0$) is less than unity. Uncer- tainty and sensitivity analyses of the model, using data relevant to the dynamics of the two diseases in Shanxi Province in rural China, show that the top ranked parameters that drive the HPV infection (with respect to the associated response function, R_{0H}) are the effective contact rate for HPV trans- mission from males to females, β_M, condom efficacy for males, ϵ_M, condom compliance rate for males, C_M, homosexual contact rate between males, ε_M, the HPV recovery rate for males, ϕ_M , the effective contact rate for HPV transmission from females to males, β_F and the fraction of females vaccinated against HPV, f. In addition, the top ranked parameter that affect TB dynamics (with respect to the response function R_{0T}) is the TB transmission rate β_T. In addition, simulations of the HPV-TB model reveal that increasing treatment rates for individuals with active TB in the singly and dually infected stages could bring down the burden of the two diseases, and increasing the condom preventability for females signifficantly reduces the cumulative co-infection new cases of mixed infections in a population.

Keywords: Human Papillomavirus, tuberculosis, co-infection, homosexual, heterosexual.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A22: MODELLING THE TRANSMISSION DYNAMICS OF AVIAN INFLUENZA INCORPORATING CONTROL MEASURES

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Abstract

In this research work, we present a mathematical model to study the transmission dynamics of avian influenza incorporating control measures. Using the next generation method, the effective reproduction number R_E is computed. The disease-free equilibrium state was found to be globally asymptotically stable when . Furthermore, sensitivity analysis was carried out on the effective reproduction number in order to determine the parameters of the model that are most sensitive and targeted by way of intervention strategy. Simulation of the model is carried out and the results are presented.

Keywords: avian influenza, effective reproduction number, sensitivity analysis, disease-free equilibrium state, simulation.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A23: Development and Analysis with Semi-Analytical Solution of HIV/TB Co-Infection Mathematical Model

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Abstract

In this work, we developed a mathematical model of HIV/TB co infection. The model is a first order Ordinary Differential Equations, in which the human population is divided into six mutually- exclusive compartments namely; TB- Susceptible individuals ( ), TB-Infected individuals ( ), TB-Recovered individuals ( ), HIV-Infected individuals ( ), Co- Infected individuals ( ) and individuals with AIDS ( ). The equilibrium states of the model were obtained and rigorously analyzed them for stability by using Bellman and Cookes theorem. The result shows that the endemic equilibrium state is stable and the disease free equilibrium state is also stable if . Also, a semi-analytical solution of the model was obtained using Homotopy Perturbation Method (HPM). From the results of the numerical simulations, it was discovered that proper admistration of anti-retroviral drugs on HIV patients and high TB treatment rates will lead to eradication of HIV/TB co-infection.

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A24: EXISTENCE AND UNIQUENESS OF THE SOLUTION OF AN INFECTION-AGE-STRUCTURED MODEL FOR HIV/AIDS DYNAMICS AND EFFECT OF PUBLIC AWARENESS, BEHAVIOURS AND TREATMENT

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Abstract

In this research work, we studied the existence and uniqueness of the solution of an age of infection of Mathematical model for HIV/AIDS dynamics incorporating public awareness, behaviours and treatment. The existence of the disease free and endemic equilibrium is established. The effective reproduction number is computed using the approach of Wang & Zhang (2016). We found that the model is well posed mathematically and shown that the solution of model equations are bounded. Therefore, there is exists a uniqueness solution of the model equations of the dynamics of HIV/AIDS.

KEYWORDS: Age of Infection; Effective reproduction number; Existence and Uniqueness; Mathematical Model; HIV/AIDS Dynamics; Public Awareness, Behaviours; Treatment

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

A25: MATHEMATICAL MODELLING OF THE TRANSMISSION DYNAMICS OF HIV/TB CO-INFECTION WITH CONTROLS IN A HIV ENDEMIC AREA.

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Abstract

In this paper, we have formulated a mathematical model on the transmission dynamics of HIV/TB co-infection with controls in a HIV endemic area using differential equations. Two other sub-models of the co-infection were also modelled, first with both diseases being treated and other with only TB receiving treatment. In all the models the effect of post-exposure prophylaxis was reorganized and considered. The models are analyzed for all the parameters responsible for the diseases spread in other to find the most sensitive parameters out of all. The effective basic reproduction numbers of the systems were obtained and shown that the disease will spread only if any of them exceeds one. The equilibrium analysis showed that, the models were asymptotically stable at the disease-free equilibrium state. Numerical simulation is done for the entire model using ODE45 module in MATLAB software built based on Runge-Kutta 4th order method which shows the population dynamics in the different compartments. The simulations also show the impact of each control measures on the transmission dynamics of the co-infection in each compartment.

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A26: MATHEMATICAL MODEL TO INVESTIGATE DEMOGRAPHIC EFFECT ON THE TRANSMISSION OF MALARIA WITH SEPARATE AQUATIC POLLUTIONS

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Abstract

In this work, a deterministic mathematical model to investigate demographic effect on the transmission of malaria was formulated and carefully analyzed. The mosquitos population were separated into two groups with different densities. The equilibrium points of the model were determined and analyzed for stability. The analysis of the disease free equilibrium state shows that it is stable under certain conditions. The model was solved using Adomian Decomposition Method (ADM).The result of the numerical simulation shows that high sanitation rate (which is common in urban area) is key to eradicating malaria in a population. Also, it was discovered that due to lack of access to modern and proper health care (which was purely based on simulation), more people die of malaria in rural settlements than in urban settlements.

Keywords: Modeling, Malaria, ADM, Equilibrium, Stability, Migration
Subject Classification: 92B05

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B: Non Epidemiological and Fluid Dynamics models

B1: BIO-ELECTRIC CURRENT SOURCE DISTRIBUTION ABOUT THE CARDIAC CONDUCTION SYSTEM

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Abstract

Action potentials pervading abutting cells and their regions rely on bioelectric sources. The sources are associated with impressed current density whose origin is nonelectrical in nature. In the cardiac conduction system (CCS) current density stems from the motion of ions due to concentration gradient, which is the chief cause of the creation of an electric field. Here we sought the quantity of current that transmit through cardiac conduction dipoles, and the concomitant potential field about the conduction system. The solution of Laplaces equation in cylindrical coordinate was found useful in furnishing the equation that holds well for the potential field in the region of interest. It is expected that the understanding of the quantity of current in the cardiac dipoles and the associated potential fields may qualitatively assist cardiac procedures.

Keywords: bio-electric; cardiac; current density; dipole; Laplaces equation.
2010 AMS Subject Classification: 47N70, 94C15, 62P10

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B2: A Nonlinear Mathematical Analysis of the Dynamics of Rainfall and Plant Resources density on the Soil Fertility of a City

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Abstract

In this paper, a nonlinear mathematical model is proposed and analysed to study the depletion of fertile topsoil due to the relational dynamics of plants resource and rainfall on topsoil. We consider the impact of heavy and continuous rainfall and the density of naturally growing plant resources on soil resource. Both the intensity of rainfall and the growth rate and carrying capacity of plant resources are assumed to exert depletive pressures on soil fertility. Both analytical analysis and numerical simulations were performed using stability theory of differential equations and MATLAB respectively.

Keywords Rainfall intensity, plant resources, stability theory, difference equations, depletion, topsoil.
Classification: Non-epidemiological

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B3: Evaluating Heat and Mass Transfer Effects of Unsteady MHD in Casson Nanoliquid Flow over a moving Melting Surface

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Abstract

Heat and ass transfer effects of unsteady MHD in Casson Nanoliquid flow over a moving Melting Surface with viscous dissipation and chemical reaction is of great concern in physical sciences, life sciences including advance research that support dynamics of environmental pollution for national development. The study therefore, evaluated heat and mass transfer effects of unsteady MHD in Casson-Nanoliquid fluid flow in porous media. The governing partial differential equations of the model were reduced to a system of coupled non-linear ordinary differential equations by applying similarity variables and solved numerically using shooting with fourth-order Runge-Kutta method. The local similarity solutions for different values of the physical parameters are presented for velocity, temperature and concentration. The results for Skin friction, Nusselt and Sherwood numbers are presented and discussed.

Keywords: Nanoliquid, Dissipation, Chemical Reaction

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B4: COMPARATIVE ANALYSIS OF MATHEMATICAL MODEL FOR PROJECTED NIGERIA POPULATION

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Abstract

Development of a country both socially and economically needs proper planning not only for the present but also for the future. The aim of this research work is to develop a mathematical model to predict the population growth of Nigeria. Nigeria is an overpopulated country, a federal constitutional republic and largest in West Africa. It shares borders with Benin in the west, Chad and Cameroun in the east and Niger in the North, the most populous in Africa and seventh in the world. The Malthus and Logistics model are used to model the Nigeria population growth. using data from 1985 to 2018. The Malthus population model predicted growth rate of 2.6%, meanwhile Logistics model predicted growth rate of 2.4% with carrying capacity of 1,761,439,545.The mean absolute percentage error for Malthus model is 0.78% and 4.90% for Logistic model. Also the mean absolute percentage error for the least square method (linear and quadratic) are 2.68% and 0.92% respectively; we compared the Malthus, Logistics and least square (linear and quadratic) method to determine the best population growth rate. Measuring the performance give an indication that Malthus method is closer to the existing data out of the four model used and it will be used to forecast the future population projected to 2060.

Keywords: Malthus population model, Logistic growth model, population growth, least square method, Linear, Quadratic

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B5: Mathematical model on terrorism population dynamics: the case of a community under the attack of multiple terrorists groups

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Abstract

Emergence of different terrorists groups have continue to pose a very serious social problem in the world today. We formulate a mathematical model that consider a scenario where there are n-multiple terrorists group invading a single community to study the dynamics of terrorism in such situation. The relevant qualitative analyses of the model were carried out accordingly. Particularly, we compute a threshold quantity R_0 that gives conditions under which the equilibrium points of the model are stable or not. Analyses of the model reveal that it is possible to eliminate all the n-multiple terrorists group provided that $R_0 < 1$. At the persistent stage when $R_0 > 1$, we discover the existence of multiple persistent equilibrium points where each equilibrium point represents a situation where one of the terrorist group dominates. Further analysis reveals possible dynamics for terrorism for this scenario when multiple terrorist is invading a community. The results of our analyses could lead to several important policy implications for the management of terrorism.

Keywords: Stability analyses, terrorism dynamics, multiple terrorists groups, numerical simulation

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B6: Dynamic Analysis of Non Uniform Anisotropic Structures Resting on Elastic Foundation under the Action of Partially distributed masses with Time Dependent Boundaries

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Abstract

This study is concerns with the dynamic analysis of non-uniform structures resting on elastic foundation with time dependent boundaries. Closed form solutions of the governing fourth order partial differential equations with variable and singular coefficients are presented. For the two-dimensional plate problem, the solution techniques is based on the double Fourier Finite Sine integral transformation, The analyses of the results shows the effect of structural parameters such as foundation moduli, rotatory inertia correction coefficient as well as the dynamic behavior of anisotropic rectangular plate under the actions of concentrated masses moving at variable velocity. It was observed that the velocity of the travelling load which brings about the occurrence of a resonance state varies in parameters when measured in different direction within the plate

Keywords: Anisotropic, Rectangular plate, Concentrated asses, Resonance, Structures, Two-dimentional.

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B7: Nonlinear Analysis of a Repeat Victimisation on Crime and Criminality: A Mathematical model

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Abstract

In this paper, a system of deterministic model is presented to analysis the impact of a repeat victimisation on the sustainability of crime and criminality. A threshold value, , responsible for the persistence of crime/criminality and victimisation, is obtained and, using it, stability analyses on the model performed. The impact of an effective psychotherapy was found to be substantial on crime and criminality. The prevention of repeat victimisation was seen to suggest a more promising option than even the non-criminalisation of victims. Numerical simulations were performed for a variety of mixing criminal scenarios to verify the analytical results obtained.

Keywords: Criminality, victimisation, repeat victimisation, criminalisation, behavioural deformation
Classification: Non-epidemiological

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B8: A MATHEMATICAL MODEL APPROACH TO POVERTY ALLEVIATION

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Abstract

In this paper, poverty is treated as a disease. A mathematical model of poverty transmission dynamics and control is developed. The model comprises of eight compartments namely: Low level class individuals (L), Middle level class individuals (M), High level class individuals (H), Poor individuals (PO), Poor Criminals (PC), Criminals (C), Jailed individuals (J) and Poverty (PV),. The existence and uniqueness of the model was established.

Keywords: Mathematical model, Poverty alleviation and Criminals.

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B9: MATHEMATICAL MODELLING OF THE EFFECTS OF PREDATION, FISHING USING NETS AND POISOINING ON FISH IN UNRESERVED WATER BODIES

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Abstract

In this paper, a mathematical model for the population growth of fish in unreserved water bodies is developed incorporating predation, fishing using net and poisoning. The model is compartmentalized according to the fish growth development namely Frey, Fingerling, Juvenile and Adult.

Keywords: Mathematical modelling, Predation, Fish, Fishing Nets and Poisoning.

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B10: Magnetohydrodynamics Rotational Stagnation Point Flow over a Shrinking/Stretching Sheet with Heat Generation/Absorption

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Abstract

In this paper, the solution to Magnetohydrodynamics rotational stagnation point flow over a shrinking/stretching sheet was analyzed usind the Adomian Decomposition. The governing partial differential equations (PDEs) were reduced with the help of similarity variables to non linear coupled ordinary differential equations (ODEs). The influences of various physical parameters were presented numerically and graphically. Numerical comparisons were carried out with the existing literature and a good agreement was established. The magnetic parameter was found to enhance the temperature profile.

Keywords: Rotational flow, Stagnation point, Magnetohydrodynamics and Adomian Decomposition Method.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B11: COMPUTATIONAL ANALYSIS OF MHD FLOW WITH HEAT AND MASS TRANSFER IN A BIFURCATING POROUS CHANNEL

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Abstract

This study examines the effect of heat and mass transfer on MHD flow of viscous fluid in a bifurcating porous channel. The governing partial differential equations are transformed to ordinary differential equations and solved analytically. The influence of the various embedded parameters on the velocity, temperature and concentration profiles are analyzed. The effect o the bifurcation angle on the transport velocity is also discussed.
Keywords: MHD flow Bifurcating Concentration Mass transfer

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B12: Hydromagnetic and Thermal Boundary Layer Flow Due to Radial Stretching Sheet with Dufour and Soret Effects

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Abstract

In this paper, the problem of Hydromagnetic and Thermal Boundary Layer Flow Due to Radial Stretching Sheet with Dufour and Soret Effects was analyzed using the Adomian Decomposition. The governing partial differential equations (PDEs) were reduced with the help of similarity variables to non linear coupled ordinary differential equations (ODEs). The influences of various physical parameters were presented numerically and graphically. Numerical comparisons were carried out with the existing literature and a good agreement was established. The magnetic parameter was found to be a reduction agent of the velocity profile.
Keywords: Radial stretching, Stagnation point, Hydromagnetic and Adomian Decomposition Method.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B13: PRESSURE VARIATION IN FLUID FLOW OVER A NONUNIFORM BOTTOM TOPOGRAPHY WITH POROUS

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Abstract

This paper presents pressure variation in fluid flow over a porous media. In the model, we considered water as an incompressible fluid; the flow as steady and uniform. We derived an equation for the nonuniform bottom topography(flow depth) and substituted into the governing equation for shallow water flow with nonuniform bottom topography. We made use of Darcys law to construct equation for Darcy flux, which in turn relate pressure gradient to the flow velocity, the porosity, and the permeability of the porous media. From the governing equation of shallow water flow with nonuniform bottom topography, we solved for the flow velocity using Homotopy Perturbation Method(HPM). We incorporated the flow velocity into the equation for the pressure gradient and solved for the pressure variation in the channel.

Keywords: pressure variation, porous media, incompressible fluid, Darcys law, Darcy flux, porosity, permeability.

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B14: MODELLING OF THE BIOMECHANICS OF GREEN PLANTS BY THE APPLICATION OF THE HOMOTOPY PERTURBATION METHOD

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Abstract

This study considers the biomechanics in the stem of green plants. The non-linear partial differential equations governing the flow were solved using the homotopy perturbation method. The effects of various parameters such as Schmidt number, porosity parameter and aspect ratio embedded in the flow were examined on the concentration profile. The results obtained were compared with existing literature. The process of translocation and transpiration were also discussed.

KEYWORDS: Biomechanics, Homotopy perturbation method (HPM).

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B15: Dynamic Response of Non-Prismatic Damped Beam subjected to Travelling Load with Time Dependent Speeds

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Abstract

The dynamic response of non- prismatic damped beam under travelling load with time dependent speeds is investigated in this paper. In order to obtain solution to the dynamical problem, a technique based on the method of Galerkin and Laplace transformation techniques in conjunction with convolution theory. The displacement response for moving load model for the dynamical problem is calculated for various time t and presented in plotted curves. Analyses shows that increase in the values of the structural parameters such as axial force N, CT is the damping due to resistance of transverse velocity, CB is the damping due to resistance of strain velocity, and foundation stiffness K reduces the response amplitudes of non- prismatic damped beam under moving loads. The resonance condition of the dynamical systems is also established.

Keywords: non- prismatic, damped beam, resonance, foundation stiffness, transverse response, Galerkin's method.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B16: A Decomposition Approach for Magnetohydrodynamics Stagnation Point Flow over an inclined Shrinking/Stretching Sheet with Suction/injection

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Abstract

In this paper, the approximate solution to Magnetohydrodynamics Stagnation Point Flow over an inclined Shrinking/Stretching Sheet with Suction/injection was analyzed via the Adomian Decomposition. The governing partial differential equations (PDEs) were reduced with the help of similarity variables to non linear coupled ordinary differential equations (ODEs). The effects of various pertinent parameters were presented numerically and graphically. Numerical comparisons were carried out with the existing literature and a good agreement was established. The angle of inclination was found to enhance the velocity profile.

Keywords: Angle of inclination, Stagnation point, Magnetohydrodynamics and Adomian Decomposition Method.

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B17: A Numerical Scheme for a Fluid Dynamic Traffic Flow Model with One-Point Boundary Condition

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Abstract

We modified the Greenberg model and used the modified version to predict density, velocity and flow profile at certain points of a highway using hypothetical initial and boundary condition data. We discovered that at any given time, there are hundreds of vehicles clustered within a given interval on our roadways.

Key words: Finite Difference Formula, Finite Difference Scheme, Numerical Simulation, Upwind Scheme, Early time behavior, Late time behavior, Traffic Flow Model.

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B18: ANALYTIC SOLUTION OF THE FRACTIONAL EULER-LAGRANGE EQUATIONS OF THE DOUBLE AND TRIPLE PENDULUMS

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Abstract

The double pendulum is a classic system used in Dynamic courses everywhere. Using Lagrangian energy method we derived the coupled fractional differential equation of motion for the system. In this paper we present the solution of the Fractional Euler-Lagrange equation of the double and triple pendulum obtained using the variational iteration method (VIM). We compare the results obtained for the fractional case $0 < \alpha < 1$ and the integer case $\alpha = 1$, where α is the order of the differential equation.

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B19: Hydromagnetic and Thermal Boundary Layer Flow Due to Radial Stretching Sheet with Dufour and Soret Effects

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Abstract

In this paper, the problem of Hydromagnetic and Thermal Boundary Layer Flow Due to Radial Stretching Sheet with Dufour and Soret Effects was analyzed using the Adomian Decomposition. The governing partial differential equations (PDEs) were reduced with the help of similarity variables to non linear coupled ordinary differential equations (ODEs). The influences of various physical parameters were presented numerically and graphically. Numerical comparisons were carried out with the existing literature and a good agreement was established. The magnetic parameter was found to be a reduction agent of the velocity profile.

Keywords: Radial stretching, Stagnation point, Hydromagnetic and Adomian Decomposition Method.

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B20: Development of an optimization model for cost minimization of fertilizer distribution in Niger State

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Abstract

Predominantly, every firm is faced with two objectives which are maximization of profit and minimization of cost. Achieving either of the objectives entails the use of effective technique(s) that enable the utilization of minimum resources for maximum outputs. Of recent most fields of studies have recognised optimization technique as one of the best technique for efficient allocation of scarce resources for optimum results. Therefore, the importance of fertilizer in the growth of agricultural sector in every economy cannot be over emphasized. The need for effective distribution of the products by the manufacturers to the consumers (farmers) at minimum cost becomes issue of concern. The cost of transportation is recognised to be the major impediments of its distribution among the users especially Niger state which is largely known for agriculture. To our knowledge, little or no used is made of mixed methods of optimization techniques in fertilizers distribution in Niger state. In light of the above problem, the study developed optimization model for cost minimization of fertilizer distribution in Niger state. Mixed methods of optimization model like Vogel approximation, Big-M and two phase simplex methods were utilized in this study. Data were analysed using TORA statistical software. Comparatively, the study revealed that Big-M and the Two Phase methods yielded better results in terms of minimization of cost more than VAM in the distributions of fertilizers from sources (factories, market) to destination of the users (farmers).Given the findings, the study recommends Big-M and two phase methods of fertilizers distributions for minimum costs and maximum outputs.

Key words: Optimization Techniques, Minimization, fertilizer distributions

Paper read at the 4th International Workshop and Conference of the Nigerian Society for Mathematical Biology (NSMB) held at the University of Nigeria Nsukka 8 - 14 September 2019

B21: ON THE RESPONSE OF NON-PRISMATIC ROTATING TIMOSHENKO BEAM UNDER THE ACTIONS OF CONCENTRATED LOADS TRAVELLING AT TIME DEPENDENT SPEEDS

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Abstract

This paper is focused on the study of motions of non- prismatic rotating Timoshenko beams traversed by moving loads. The versatile Galerkin's method and the integral transform techniques were employed to treat the coupled second order partial differential equations governing the motion of the vibrating system. Numerical analyses in plotted curves are presented. The analyses depict interesting results on the effect of some structural parameters on the dynamic behaviour of Timoshenko beams under the actions of moving loads at time dependent speed. It is found that the response amplitude of the beam decreases as the values of these structural parameters increase. The resonance condition of the dynamical systems is also established.

Keywords: non- prismatic, resonance, foundation stiffness, prestressed, transverse response, Galerkin's method, time dependent speed.

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C: Other Mathematical Sciences

C1: MODIFICATION OF SUCCESSIVE OVERRELAXATION ITERATIVE (SOR) METHOD FOR M-MATRICES

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Abstract

A new preconditioner for speeding up the convergence of the SOR iterative method for solving the linear system Ax=b is proposed. Arising from the preconditioner, two new preconditioned iterative techniques of the SOR method are developed. The preconditioned iterations are applied to the linear system whose coefficient matrix is an M-matrix. Convergence analysis conducted with standard procedures established convergence of the preconditioned iterations. Numerical examples and comparison results are in conformity with the analytic results.

Keywords: SOR method, preconditioner, M-matrix, convergence, spectral radius

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C2: An Analysis of Latest CD4 Counts of HIV Infected Patients Using Logistic Regression Approach

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Abstract

The morbidity pattern of HIV/AIDS patients in Nigeria motivated this work. In this study, we conducted both stepwise regression analysis and binary logistic regression analysis to the data of HIV/AIDS patients collected from State Hospital Ota, Ogun State in other to predict the latest CD4 Count of patients. Also, Pearson product moment correlation coefficient was used to determine the relationship that exit between the variables under study. From the result of the stepwise regression analysis out of the seven independent variables used as regressors, the major predictor variables were baseline CD4 count, age, regimen, and clinic status while gender, opportunistic infection status and location were not. From the predictions made, we observed that a patient, for instance who is 39years old on the highest regimen with a baseline CD4 count of 296 who is regular (active) at the clinic, is more likely to have a normal latest CD4 count while a patient of the same age, baseline CD4 count and regimen but is lost to follow up, has a 50-50 chances of having a normal latest CD4 count or not and the patient with similar attributes but that has been transferred out from State Hospital Ota, is likely to have a normal latest CD4 count. In conclusion, patients who remain active and receives drugs at State hospital Ota, are more likely to have normal latest CD4 counts than those who are transferred out or lost to follow up.

Keywords: HIV/AIDS; CD4 Count; Regression Analysis; Correlation

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C3: COMPARATIVE FORECASTING PERFORMANCE OF GARCH AND GAS MODELS IN THE STOCK PRICE TRADED ON NIGERIAN STOCK EXCHANGE

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Abstract

This paper compares the forecasting performance of GARCH and GAS models on the daily adjusted close price of stock traded on the Nigerian Stock Exchange from December 10, 2013 to February 07, 2019. The GARCH and EGARCH models were selected from the GARCH models whereas the GAS and EGAS were selected from the GAS models. Assuming three different probability distributions for the innovations of the volatility models, several forecasts measure were obtained. Based on the forecasts measure which are Mean Error (ME) and Theil Inequality (TI) obtained, the forecasting performance of the volatility models was achieved. The results showed that the GAS model performed better when compared to the GARCH model under the three distributional assumptions in terms of ability to forecast future volatilities. However, the EGAS model performed better when compared to the EGARCH model when the normal distribution was assumed but the EGARCH performed better when student-t distribution was assumed.

Keywords: GARCH Models, GAS Models, Innovations, Probability Distribution, Forecasts Measure

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C4: On Some Recent Results Concerning Convergence Theorems for Asymptotically Nonexpansive Mappings and Asymptotically Nonexpansive Semi-groups

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Abstract

We observe that the proofs of some recent results concerning approximation of fixed points of asymptotically nonexpansive mappings and asymptotically nonexpansive semi-groups appear to be faulty. We provide a leeway out of the observed shortcomings and hence enhance the results in question.

MSC: primary 47H09; secondary 65J15

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C5: COMPARATIVE STUDY OF BAYESIAN CONTROL CHART AND SHEWHART CONTROL CHART IN INDUSTRIAL FRAMEWORK

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Abstract

Since the invention of control chart by W. A. Shewhart in 1924, control charts have become a major tool to monitor the process stability in many industries. Many of these control charts are constructed using Frequentist method which depends on the large sample size to produce a precise result. In this study, a Bayesian Control Chart is established since Bayesian statistical method does not depend on large sample asymptotic theory to make a precise result and it is compared with Shewhart control chart, that is, $\overline{X}$-Chart and S-Chart in detecting shifts in the process mean. This comparison is done using data from Aluminium Roofing Sheets. The results of the charts depicted that the posterior 3-sigman control chart obtained from Bayesian method gives more information about the process mean and variation within the system than the traditional $\overline{X}$-Chart and S-Chart.

KEYWORDS: Control Charts, Prior Distribution, Likelihood, Posterior Distribution, Markov Chain Monte Carlo, Convergence, Bayesian Control Chart, Region of Practical Equivalence, Control Limits

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C6: STATISTICAL ANALYSIS OF AGE MISREPORTING ON DEMOGRAPHIC DATA

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Abstract

This research aims at analyzing age misreporting on 2006 population census demographic data. The collected data was analyzed using such techniques as: Age Ratio, the United Nations Age-sex accuracy Index and Myers Index. The analyses carried out using age ratio showed that among the age groups, there were some people who were not supposed to belong to some age groups but were classified into such groups and there were some people who were supposed to belong to some age groups but were mis-classified into some other age groups. The value for United Nations Age-sex accuracy Index (UNAI) also gave an indication of high level of age misreporting. The value for Myers Index showed that in the age reporting, some people preferred quoting ages that ended in a particular digit .Hence each of the methods of analyses gave an indication of age misreporting during the 2006 population census. One of the recommendations is that a statistical analysis should be carried out on the collected age data using the demographic techniques used in this work to determine the accuracy of the collected data before using it for developmental planning.

Key words: Age misreporting, Age ratio, United Nations Age-sex accuracy index, Myers index, Demographic data.

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C7: A REVIEW OF TESTS FOR EXPONENTIALITY WITH MONTE CARLO COMPARISONS

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Abstract

This paper reviews thirty (30) different techniques for determining whether a continuous set of data comes from an exponential distribution. For some selected sample sizes n, the empirical type-I-error rates of the techniques are compared through extensive Monte Carlo simulations. Also for some selected n, the powers of the techniques are compared using three different classes of distributions alternative to the exponential distribution. The comparisons showed that powers of the various tests depend on n, and the class of the alternative distribution which is in terms of the monotonicity of their hazard rates. Also, the results showed, among other things, that some techniques are generally better than others in terms of type-I-error rate and power of the test.

Keywords: hazard function; goodness of fit tests; Monte Carlo simulation; power of a test; type-I-error rate.

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C8: On the comparison of methods of outlier detection in a simple linear regression analysis

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Abstract

Examination of data for outliers is now part of model building. Thus, detection of outlying observations is very essential in the process of model building in various fields of study. This study compares three outlier detection methods commonly used in linear regression analysis. The methods are Cooks statistic, DFFITSi, and Atkinsons modified Cooks statistic. The study proposes possible cutoff points for these methods using data simulated from simple linear regression model with different parameters and parameter combinations. We observed that some of the cutoff points already established in published works are unreliable. Furthermore, it is observed that among the three methods considered herein, DFFITSi method performed better than the other two methods when the already established cutoff points were used. However, we observed that Cooks Statistic is the best method using our proposed cutoff points to compare the three methods. It is observed that the performances of the methods are affected by the number of outliers present in the data set.

Keywords: Linear regression models, Monte Carlo Simulations, Outlier detection

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C9: On The Efficiency Of Health Systems In West Africa: A Data Envelopment Analysis Approach

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Abstract

Data Envelopment Analysis was used to determine the efficiency of health systems of 16 countries in West Africa. We attempt to provide explanations on the inefficiencies of health systems in West Africa. This method allows us to evaluate the ability of each country to transform its sanitary inputs into health outputs. Our results show that, on the average, the health systems of these countries have an efficiency score between 32% and 96% of their maximum level.

Keywords: Technical Efficiency, Data Envelopment Analysis, Health System, health performance
Classification: Optimization

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C10: A REGRESSION ANALYSIS OF THE IMPACT OF SOME ECONOMIC VARIABLES ON ECONOMIC GROWTH (GDP). A CASE STUDY OF NIGERIA ECONOMY (1981-2016)

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Abstract

This research work examines the impact of government expenditure and unemployment rate on economic growth and other core macro-economic variables like inflation rate and exchange rate in Nigeria for a period of 36 years (1981-2016). In this research, multiple linear regression, ordinary least square and partial correlation was used in the analysis. From the results gotten, government expenditures, which include capital expenditure, and recurrent expenditure are statistically significant and also have positive effect on economic growth rate in Nigeria with values 0.000230 and 0.000326 as coefficients respectively which implies that increase in government expenditure will lead to increase economic growth rate. Also, unemployment rate has a negative effect on economic growth rate with a value of 0.03646 as its coefficient, meaning that as unemployment rate continues to increase, Gross Domestic Product (GDP) will be decreasing. Inflation rate which is not statistically significant but having a value of 0.00045 as its coefficient shows a negative relationship with economic growth rate. Exchange rate with a value 0.004700 as its coefficient being statistically significant has a positive relationship with economic growth rate and there is a negative relationship between unemployment rate and economic growth with a value of -0.449. In conclusion, this study has shown some positive effects of exchange rate on economic growth rate in Nigeria and these are increase in exportation, shrink in trade deficit and reduction in sovereign or government debt burdens.

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C11:1PROSPECTS OF MANPOWER SYSTEM DEPARTMENTALIZATION IN STATISTICAL MANPOWER MODELLING AND CONTROL

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Abstract

In past statistical manpower studies, until a few years ago, a manpower system has been considered as a unified set of individuals facing similar system conditions along cadre or length of service divide only. In the concept of departmentalization, a manpower system is viewed as a conglomerate of k subsystems, each having the capacity of entertaining peculiar considerations. This paper highlights the prospects of this subsystem configuration of a manpower system. Its application in Markov manpower modelling and control is also presented.

Keywords: manpower system, departmentalization, Markov model, statistical manpower control

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C12: ON SELECTION ALGORITHMS

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Abstract

Strong convergence of an iteration scheme for approximating the common elements of the set of solutions EP(F) of an equilibrium problem for a bifunction F and the set of fixed points F(T) of a multi-valued (or single- valued) hemicontractive mapping T is established in a real Hilbert space H. This work contributes to the study on the applicability and computability of iteration schemes for approximating the solutions of equilibrium problems for bifunctions involving the construction of the sequence $\{K_n\}_{n=1}^{\infty}$ of closed convex subsets of H from an arbitrary $x_0 \in H$ and the sequence $\{x_n\}_{n=1}^{\infty}$ of the metric projections of x_0 into K_n. The results obtained extend and improve many results in this direction in the contemporary literature.

Key words and phrases: Hilbert spaces, strong convergence, equilibrium problem, order inclu- sion transitive, resolvent, bifunction, hemicontractive mapping.

2010 Mathematics Subject Classi
cation: Primary 47H10,47H04, 49J53, 40D05,65D15, 54H25.

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C13:CHURCH GROWTH MONITHORING SYSTEM

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Abstract

This project work presents a growth monitoring system for a church that can be accessed by only an administrator. This system was designed considering the problems of existing system; problems such as registration of members and maintenance of such information, random financial recording and difficulty in auditing. This system is designed to show the financial progress of the church in the various sources respectively with easy auditing in view, it makes registration of prospective members easy and this information is kept saved in the database, it is also opened to update. This system was designed using the OOAD methodology and implemented using Netbeans 8.2 IDE on windows 10 system using Java programming language and MySql workbench. This system present a platform where data are entered and stored and as well can be accessed or retrieved for the purpose of showing a tabular and a fairly graphical picture of the church activities that captures the church progress. Information that has been stored can be printed for proper checking.

Keywords: Church, Monitoring system, platform, auditing and growth.

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C14: Evaluating the Volatility Forecasting Performance of Distributional GARCH Models in Nigeria Exchange rate returns

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Abstract

This study uses information criteria to accurately identify the best error distributional assumption in a GARCH-type model using both simulated and empirical exchange rate data of United States Dollar and Nigeria Naira (USD/NGN). The forecasting ability of various GARCH-type models with normal, student-t, generalized error distributions and their skewed versions using the daily closing values of exchange rate data from United States Dollar and Nigeria Naira (USD/NGN) spanning the period from December 29, 2010 to December 27, 2015 (1,825 observations) are examined. The simulation results for the six error distributions considered suggest that the information criteria choose the wrong model for sample sizes less than 500. Among all the information criteria considered, Bayesian information criteria (BIC) and Hannah and Qunnin information criteria (HQIC) performed well and selected the true data generating process (DGP) with high probabilities. Also, the results of the simulation show that, for different error distributions the Mean Square Error (MSE) and Mean Absolute Error (MAE) functions are too large for sample sizes less than 500 and relatively small for sample sizes 500 and above. The results of empirical data analysis, in-sample fit based on the four information criteria show that various GARCH-type models with the generalized error distribution are most superior to the GARCH-type models with different error distributions. However, in terms of the out-sample forecast performance based on the statistical loss functions of MSE and MAE, the result is not decisive. There is no single error distribution volatility model which dominated the others. This means that any of the above six error distributional assumptions can be used to model the USD/NGN exchange rate.

Keywords: Error distributions, Exchange rates, GARCH-type models & Information criteria

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C15: On the Performance of the Randomization and F tests in analysis of Repeated Measures Design with Missing observation

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Abstract

Randomization test provides an excellent solution in the presence of unsuitable conditions for use of F-test. In this work, the randomization test and F-test were used to analyze single factor repeated measures design with missing observations when data are normal and skewed. The performance of both tests was compared on the basis of statistical power and p-value. The Monte Carlo approach was used to draw a sample of 10,000 permutations from the randomization empirical sampling distribution. Also, the R statistical computing software was used to simulate random numbers to represent normal and non normal situations using parameters from a sensory adaptation experiment. The results showed that in the presence of missing observations, the randomization test was as powerful and robust as the F-test for normal data. When data are skewed, the randomization test was substantially more powerful and robust than the F-test. The randomization test was therefore recommended to replace the F-test in analyzing single factor repeated measures design in the presence of missing observations.

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C16: The order completion method: Existence and regularity of generalized solutions of initial value problems

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Abstract

In this study, generalized solution to the initial value problem of space-time first order partial differential equation is constructed using the order completion method in the setting of convergence vector spaces. Global existence and local regularity of generalized solutions of the space-time IVP is obtained. Our result directly applies to well known partial differential equation in space and time variables.

Key words: Order completion method, Convergence vector spaces, Existence of solution
AMS Mathematics Subject Classification (2010): 46F30; 35D99; 46A40; 46A19; 54E15

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C17: Multivariate statistical process control charts and Mason-Young-Tracy decomposition technique for quality improvement to cable products

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Abstract

Multivariate statistical process control (MSPC) charts are used for process monitoring and control of two or more variables simultaneously for quality and quality improvement. The three most popular charts in MSPC for process monitoring and control of the mean vector are the Hotelling control chart, multivariate cumulative sum (MCUSUM) and multivariate exponentially weighted moving average (MEWMA). A usual problem in the use of the MSPC charts is the identification and interpretation of variable(s) responsible for an out-of-control signal that occurred in the chart. This has brought many developed techniques from many researchers to aid in finding the variable(s) responsible for the out-of-control signal in the MSPC chart. Thus, the work is aimed at using the Mason-Young-Tracy decomposition technique for identifying and interpreting an out-of-control signal in the MSPC charts when applied to cable products.

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C18: Congestion Control on GSM/GPRS Network, Using Call Duration Control Scheme and Priority Queue Discipline

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Abstract

Within a short period of its existence, the Global System for Mobile Communication (GSM) has evolved into advanced network technology, like General Packet for Radio Service. This evolution has led to the integration of voice and data services into the mobile network. This has increased the volume of traffic on the network. This situation has resulted to congestion, a situation where the number of callers is more than the number of communication resources, like channels. This paper develops analytic model that uses novel scheme, called call duration control to control congestion on the network. The novel scheme determines the duration of call using blocking probability and priority level of the caller. This scheme effectively controls congestion while providing fair access to the network, and gives subscribers value for money.

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C19: Convergence theorems of Ishikawa-type algorithm to the solution of split equality fixed point problem for lipschitz alpha-hemicontractive mappings in Hilbert spaces

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Abstract

We propose, in this paper, a new Ishikawa-type algorithm to solve split equality fixed point problem in the case where the mappings are Lipschitz $\alpha-$ hemicontractive. We prove that the proposed algorithm converges weakly to solution of the problem. Again, we show that under additional mild conditions, the algorithm converges strongly to the solution of the problem. Our theorems compliment and improve the results of Chidume *et al* [5] , Okpala *et al* [10] and references there in.

keywords: Lipschitz $\alpha-$ hemicontractive mappings, bounded linear operator, Split equality problem, Fixed points, Strong convergence, Weak convergence.

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