MATH MODEL RESEARCH GROUP

DEPARTMENT OF MATHEMATICS

FEDERAL UNIVERSITY OF TECHNOLOGY (FUT), MINNA, NIGERIA

BOOK OF ABSTRACTS

for the

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HYBRID (VIRTUAL & PHYSICAL)

Theme:

CONTEMPORARY ISSUES ON THE CONTROLS OF DISEASES EPIDEMICS AND PANDEMIC

DATE: Thursday 22nd February, 2024 **TIME:** 10:00am Prompt

VENUE: Department of Mathematics, Federal University of Technology Minna, Nigeria

PROFESSOR N. I. AKINWANDE FNMS

Convener

B19: Derivation and Implementation of a-Stable Hybrid Block Numerical Method for Solving Stiff Ordinary Differential Equations

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Abstract

A new 2-point hybrid block method for the numerical solution of first-order stiff systems of ordinary differential equations in initial value problems with optimal stability property is presented. The necessary and sufficient conditions for the convergence of the proposed implicit block numerical scheme for solving stiff ODEs are established. The stability and convergence analysis of the method show that it is consistent, zero-stable, and convergent. The absolute stability region of the method is plotted, indicating that the method is A-stable. The method is implemented in Microsoft Dev C++ environment using the C programming language and Newton's iteration, and some selected first-order stiff initial value problems are solved. The numerical results obtained for the proposed method are compared with the existing fully implicit 2-point block backward differentiation formula and 2-point block backward differentiation formula with two off-step points methods. The comparison reveals that the new method outperforms both methods in terms of accuracy and computation time as we reduce the step size. It is evident that the method converges faster.

Keywords: A-stable, hybrid block method, Stiff IVPs, Convergence and Block Backward Differentiation Formula.

B20: Studying the Impact of Some Thermal Properties in Mhd Fluids on Heat and Mass Transport Flow Within a Plate Embedded with Radiation and Heat Source

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Abstract

This research investigates the impact of certain thermo-physical properties of a fluid on the flow of heat and mass transfer through free convection. The fluid in consideration is a chemically reacting, viscous, incompressible, and electrically conducting substance flowing past an infinite porous plate. The process is influenced by a uniform transverse magnetic field, with the fluid being optically thin, allowing the modeling of thermal radiative heat loss through the Rosseland approximation. A uniform magnetic field is applied perpendicularly to the plate,

and the fluid experiences a normal suction velocity, while the heat flux at the plate remains constant. The study involves solving the dimensionless partial differential equations governing the phenomenon through analytical methods, specifically employing the Olayiwola Generalized Polynomial Approximation Method (OGPAM). The obtained results illustrate the influence of various thermo-physical parameters on fluid flow, as well as heat and mass transfer characteristics, presented graphically. Skin-friction coefficient and Nusselt number values at the plate are numerically derived and discussed for different physical parameter values, presented in tables. The research also explores the effects of a generating heat source on fluid velocity and temperature, revealing that an increase in thermal radiation amplifies both the velocity and temperature profiles of the flow, thereby intensifying the convective flow.

Keywords: Convective flow, Heat and mass transfer, Heat source, MHD free convection, Porous medium, Thermal radiation, Unsteady flows.

B21: Analytical Approximation solution for Integro Delay Differential Equation

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Abstract

Delay Differential equations (DDEs) are types of functional equation having a wide range of application in the arena of sciences and engineering. Over the years, the application of these equations had shown in control theory and recently in various biological models. However, several techniques have experienced difficulties in finding a convergent approximate analytical solution of certain types of these equations. Therefore, in this work, the He-Natural Homotopy Analysis Method is used for analytical treatment of integro delay differential equation. The method is a blend of Natural transform and Homotopy analysis method. Based on this approach the Solution of this equation is given in form of rapid convergent series where the He's polynomial is used for series calculation of nonlinear terms. Hence, the result indicates that method is analytically efficient for handling such type of DDEs.