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A Stochastic Numerical Approach to Study Stagnation Point Carreau Nanofluid Flow Impacted by Thermal Radiation and Activation Energy

Eman Fayz A. Alshehery[1*], Eman Salem Alaidarous[1], Rania. A. Alharbey[1], Muhammad Asif Zahoor Raja[2]

[1]Department of Mathematics, Faculty of Science, King Abdulaziz University, Jeddah 21589, Saudi Arabia

[2]Future Technology Research Center, National Yunlin University of Science and Technology, Douliou, Yunlin 64002, Taiwan

[*]Corresponding author's e-mail: eabdulrahmanalshehery@stu.kau.edu.sa

ABSTRACT

The motivation behind this research is the great interest that nanofluids have received from scientists and researchers due to their exceptional thermal performance in heat transfer processes. Moreover, employing artificial intelligence and its various technologies to solve real-life problems. This research studies the two-dimensional stagnation point Carreau nanofluid flux (2D-SPCNFF) across a stretching sheet that is impacted by thermal radiation and Arrhenius activation energy. The mathematical formulation of the problem is signified through a nonlinear partial differential equations (PDEs) system that was diminished to a nonlinear ordinary differential equations (ODEs) system by applying the correspondence transformations. The ordinary differential equations ODEs are solved by employing the Lobatto IIIA method using the bvp4c package in MATLAB regarding different values of physical parameters. The solution of ODEs is used as a dataset with the nftool technique in MATLAB to design a stochastic numerical approach by the Levenberg Marquardt backpropagation neural networks approach (LMB-NNA). The efficiency, consistency, and convergence of the proposed approach are illustrated by both graphical and numerical consequences using the mean squared error, histograms for error, and linear regression. Numerical solutions by LMB-NNA for the 2D-SPCNFF problem which explain the performance of the flux velocity, fluid temperature distribution, and fluid concentration of the flow under the effect of the mixed convection parameter, Hartmann number, Ecker number, activation energy parameter, radiation parameter, heat generating parameter, and reaction rate, is shown graphically. With rising heat generation parameter, radiation parameter, and Ecker number values, the temperature distribution grows. For the large rate of an activation energy parameter, the concentration increases.

Keywords: Nanofluid; Lobatto IIIA; Levenberg Marquardt

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