UNIVERSITI TEKNOLOGI MARA

MATHEMATICAL MODELLING ON MHD FLOW OF A NANOFLUID OVER A STRETCHING/SHRINKING WALL USING BVP4C (P33S23)

AFIQAH BAHARUDIN, NUR AINA AQIELA MOHD ZAM & NURIN BATRISYIA ABD AZIZ

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ABSTRACT

Magnetohydrodynamics (MHD) combined electrodynamics and fluid dynamics, introducing fundamental ideas in fluid dynamics such as boundary layer and stagnation point flow. This study was initiated due to an insufficient number of investigations focusing on how MHD flows on nanofluids are affected by stretching/shrinking walls. Additionally, most studies concentrated on hybrid nanofluids in general and did not utilize the BVP4C method to solve the problems in their studies. The objectives of this study were to determine the mathematical model for MHD flow of nanofluids driven by stretching/shrinking walls, to compare the results using BVP4C, and to analyze the obtained numerical solution. To derive the mathematical model, the partial differential equation was transformed into an ordinary differential equation for problem-solving. Numerical results were obtained using BVP4C in MATLAB software. Then, the results of the velocity profile $f'(\eta)$, temperature profile $\theta(\eta)$, nanofluid concentration profile $\phi(\eta)$, skin friction coefficient $f''(0)$, heat flux $-\theta'(0)$ and mass flux $-\phi'(0)$ were interpreted and discussed. The result shows that as magnetic parameter M increased, $f'(\eta)$ also increases. In addition, $\theta(\eta)$ and $\phi(\eta)$ increased when thermophoresis parameter Nt increased. Furthermore, $f''(0)$, $-\theta'(0)$ and $-\phi'(0)$ were also increase as constant mass flux s, Biot number Bi and Brownian motion parameter Nb increased respectively. A few recommendations could be implemented for future studies, such as using BVP5C an alternative solver and apply the model for hybrid nanofluid. Future studies could also try to identify the second solution for the problem of this study. In conclusion, BVP4C method produced the same result as shooting method. These affirms the reliability and efficacy of this numerical approach in solving complex problems that were associated with MHD flows of the nanofluid. All in all, it can be concluded that the main objective of the study have been achieved.

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