MHD boundary layer flow and heat transfer of a nanofluid over a static wedge with suction/injection

Divya Darshini S
Dr Ambedkar Institute of Technology, Bengaluru, India

1. INTRODUCTION & OBJECTIVE

We aim to study the effects of magnetic field and suction/injection of a steady, two-dimensional, viscous and laminar boundary layer flow and heat transfer of nanofluid over a constant wedge. The magnetic field is uniform and is applied in the direction normal to the fluid flow. The assumption of mainstream flow in terms of a distance along the wedge surface in the streamwise direction demonstrates the self-similar solutions to the boundary layer equations. The partial differential equations that govern the flow over a constant wedge are converted to system of nonlinear ordinary differential equations through the similarity transformations. The resulted equations are solved using three different methods: we obtain the exact and asymptotic solutions to the momentum boundary layer equation and numerical solution to the full nonlinear system for various physical parameters. The model considered to study nanofluid is single-phase model. Two different types of nanoparticles such as copper and silver in which water is taken as a base fluid are considered for case study. The characteristics of MHD boundary layer flow and heat transfer are studied in terms of velocity and temperature profiles as well as velocity and temperature gradients on the constant wedge. The results show that the boundary layer thickness is found to be thinner for copper and silver compared to the normal fluid. The thermal boundary layer is thicker in the nanofluid.

2. RESULTS & HIGHLIGHTS OF IMPOINTANT POINTS

We study the two-dimensional MHD boundary layer flow and heat transfer of two different types of nanofluids including suction/injection parameter effects. By means of similarity transformations, the governing equations which are partial differential equations are converted into ordinary differential equations and thereby solved using analytical, asymptotic and numerical methods. The results that are obtained are shown graphically and tabulated for some values of pressure gradient parameter (β), suction/injection parameter (α), MHD (M) etc. Velocity of boundary layer decreases for increasing values of M because of the applied magnetic field and for increasing α, the thickness of the boundary layer increases whereas thickness of thermal boundary layer decreases.

3. REFERENCES

1. SUS Choi and JA Eastman, *Enhancing thermal conductivity of fluids with nanoparticles*, Development and Applications of Non-Newtonian Flows, ASME, 1995.
2. JC Maxwell, *A Treatise on Electricity and Magnetism*, Clarendon Press. 1881.
3. S Abbasbandy and T Hayat, *Solution of the MHD Falkner-Skan flow by homotopy analysis method*, Commun Nonlinear Sci Numer Simulat **14**, pp 3591-3598, 2009.