World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:11, No:02, 2017

A Mathematical Study of Magnetic Field, Heat Transfer and Brownian Motion of Nanofluid over a Nonlinear Stretching Sheet

Authors : Madhu Aneja, Sapna Sharma

Abstract : Thermal conductivity of ordinary heat transfer fluids is not adequate to meet today's cooling rate requirements. Nanoparticles have been shown to increase the thermal conductivity and convective heat transfer to the base fluids. One of the possible mechanisms for anomalous increase in the thermal conductivity of nanofluids is the Brownian motions of the nanoparticles in the basefluid. In this paper, the natural convection of incompressible nanofluid over a nonlinear stretching sheet in the presence of magnetic field is studied. The flow and heat transfer induced by stretching sheets is important in the study of extrusion processes and is a subject of considerable interest in the contemporary literature. Appropriate similarity variables are used to transform the governing nonlinear partial differential equations to a system of nonlinear ordinary (similarity) differential equations. For computational purpose, Finite Element Method is used. The effective thermal conductivity and viscosity of nanofluid are calculated by KKL (Koo – Klienstreuer – Li) correlation. In this model effect of Brownian motion on thermal conductivity is considered. The effect of important parameter i.e. nonlinear parameter, volume fraction, Hartmann number, heat source parameter is studied on velocity and temperature. Skin friction and heat transfer coefficients are also calculated for concerned parameters.

Keywords : Brownian motion, convection, finite element method, magnetic field, nanofluid, stretching sheet
Conference Title : ICCFD 2017 : International Conference on Computational Fluid Dynamics
Conference Location : Barcelona, Spain
Conference Dates : February 26-27, 2017