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Current advancements in fluid-flow Problems: A brief review

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Abstract

This specific article is a compilation of a few current studies on fluid flow issues. This article provides an overview of current research on the experimental and theoretical analysis of various nanofluids' thermal conductivity. The current study examines a number of variables that have a significant impact on a nanofluid's ability to transfer heat, including temperature, solid volume fraction, type, size, shape, magnetic field, pH, ultrasonic time, and surfactant. In addition, some plausible and appealing theories that enhance the thermal conductivity of nanofluids are mentioned. The final important heat transmission mechanisms that play a significant part in improving thermal conductivity are Brownian motion, thermophoresis, nanoclustering, interfacial nano-layer, and osmophoresis. Thus, consideration is given to the heat transmission properties of nanofluids. And also discussed some Numerical method to solve fluid flow problems.

Keywords: Heat transfer; Nano-fluid; MHD boundary layer; Stretching/shrinking sheet; Heat source/sink; Finite Difference Method

1. Introduction

A mathematical and numerical investigation about the two phase thermal boundary layer flow with non-uniform grid has been carried out by Mishra et al.[1,2]. In an another study byTripathy et al. [3] the momentum integral method has been employed by using third degree profiles for velocity, temperature and particle density to study the thermal boundary layer characteristics over a flat plate. They observed that, the particle velocity, the particle density and the temperature on the plate approaches a finite value towards the downstream. This study concentrated on the steady flow of viscous incompressible fluid with uniformly distributed suspended particulate matter past a wedge by Tripathy et al. [4]. The volumetric force given by Stokes' drag, the finite volume fraction, diffusion of particles through the carrier fluid have been included in the formulation of the problem to show the effect of these forces on the flow over a wedge. Momentum integral method has been employed by Bishoyi et al.[5] to study the effect of suspended particulate matter (SPM) on two-phase free convection heat transfer from a vertical plate. The presence of SPM increases the velocity of the carrier fluid whereas diffusion of particles and concentration of particles in the fluid has little effect on it. Mishra et al. [7,8] have obtained a numerical investigation of free and forced convection two-phase flow over a wedge. After that Tripathy et al.and Das et al. [9, 10 ,11] has analyzednumerical Simulation of Forced Convection Two-Phase Flow Over a Adiabatic Plate using non-uniform grid, the Eulerian-Eulerian approach.

Tripathy et al. [12] have studied flow and heat transfer in a laminar plane wall jet in dusty fluid. They have used perturbation methods to solve the systems of differential equations and have observed that Nusselt number always increases with the increase of the parameters like, diffusion parameter, size of the particles and concluded that heat always transform from fluid to plate in all the cases.Samantara [13,15] have gone through the generation of electricity due to hitting of particles with each other and with the wall of the flow and its impact on motion of flow particles. The systems of equations representing the flow are solved by finite difference method. It concludes from outcome of computation that the particle velocity rises with rise of electricity generation and increasing size of particles.Tripathyet

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al. [14] have analyzed the mathematical model of turbulent boundary layer (TBL) flow characteristics with suspended particulate matter (SPM). Ray et al. [16] have overdone the flow and heat transfer of dusty flow over a linear stretchable sheet. The effects of radiation and non-uniform heat source or sink have been studied. The formulation consists of systems of nonlinear PDEs which has been converted to a system of ODEs by taking suitable similarity transformations. Then the systems of ODEs have been solved by using Runga-kutta method of 4th order. It is concluded that the presence of particles in fluid has some impact on different parameters in flow and heat transfer. The parameters like Eckert number, Fluid- particle interaction parameter, diffusivity parameter have remarkable effects of presence of particles. Das et al. [17] have gone through the radiation effects on the unsteady MHD free convection flow past in an infinite vertical plate with heat source. The governing equations are solved for the velocity field & temperature by using perturbation technique in terms of dimensionless parameters.Numerical simulation of the circular two phase jet flow and heat transfer has been analyzed by Bishoyi et al.[18]

Numerical simulation of the Darcy–Forchheimer dynamics of a Casson material in a circular tube subjected to the energy losses due to the viscous heating and Joule dissipation mechanisms is performed by Mahanthesh et al. [19] Mishra et al. [20] have studied an analysis on flow and heat transfer with in a two-dimensional unsteady radiative boundary layer with fluid-particle interaction. The impacts of various parameters on the flow field have been discussed and determined the heat transfer characteristics. The stronger electric filed significantly enhances the temperature of both fluid and particle phase, which occurs more heat transfer on the surface. Tripathy et al. [21] have analyzed flow and heat transfer mixed convective boundary layer particle laden flow past an exponentially stretchable permeable surface. The flow was originated due to the surface stretched exponentially. A two-phase radiative transfer equation (RTE), considering radiation by both fluid and particle phase is considered for formulation of the problem. The heat transfer is significantly influenced with the combined effect of thermal conductivity, buoyancy force and radiation by both fluid and particle phases. Kanungo et al. [22] have gone through a parametric study to investigate the impact of electrification and radiation inside a thermal particulate boundary layer, where the flow is due to an unsteady stretching sheet in presence of non-uniform heat source/sink.it is concluded that the presence of particles in fluid has greater impacts on flow and heat transfer profiles.Mixed convection two-phase flow of Maxwell fluid under the influence of non-linear thermal radiation, non-uniform heat source/sink and fluid-particle suspension is studied by Girishaet al.[23] The convective contributions to flow and heat transfer process are neglected due to slow motion. These render the governing equations linear, paving the way for solution by Laplace Transform. An analysis by Ishaket al. [24] to the free convective unsteady MHD flow of a viscous fluid through a saturated porous medium, considering the radiative heat loss and chemical reaction of the diffusing species in the presence of an exponential time-varying cross flow.Mishra et al. [25] have gone through the flow and heat transfer of dusty flow over a linear stretchable sheet has been analyzed. The effects of radiation and non-uniform heat source or sink.it is concluded that the presence of particles in fluid has some impact of different parameters in flow and heat transfer. The parameters like Eckert number, Fluid- particle interaction parameter, diffusivity parameter have remarkable effects of presence of particles.

S.Kanungo et al. [26] have studied particle laden boundary layer flow with existence of electrification of particles has been studied over an inclined permeable stretching sheet. it was concluded that the presence of particles in fluid has greater impacts on flow and heat transfer profiles. Mishra et al. [27] have studied the impact of electrification of suspended particles in a fluid flow and heat transfer. It is concluded that electrification of particles reduces the numerical value of velocity of fluid and temperature of fluid and particles. So, it reduces heat transfer and skin friction. Further the increase of Prandtl number (Pr) results in the decrease in temperature distribution. Tripathy et.al [28]The numerical investigation of the flow and heat transfer of steady dusty flow over a linear stretching sheet has been carried out. The effects of Transverse force and electrification has been incorporated in this problem. Modelling of the problem comprises of highly nonlinear partial differential equations that have been transferred to systems of ordinary differential equations by implementing suitable transformations. Since the equations are of boundary value problems in nature, have been transferred to initial value problem by using shooting method and then solved by Runge-Kutta 4th order technique.Effect of radiation evolved from fluid and particle, on a convective balanced boundary layer dusty fluid flow model has been analyzed over a vertical stretching surface by Tripathy et al. [28]. Panda et.al have studied modeling of laminar circular two phase jet flow and heat transfer by using discretisation of domain and using finite difference method.In an article Abel et al., [31] have discussed about the heat transfer and boundary layer flow over a stretching sheet. An investigation on flow and heat transfer over an unsteady stretchable sheet with slip conditions was conducted by Mukhopadhyay and Andersson [32].

2. Conclusion

A study of the literature on fluid flow in various flow geometries that takes into the impacts of different flow parameters has been done. The applied magnetic field has an impact on the fluid temperature and velocity in the majority of the situations addressed, which is one of the study's key findings. The primary influences on temperature profiles

areseveral characteristics, including radiation, the velocity ratio, free and forced convection, and the Prandtl number (Pr). These fluid flow issues are relevant to numerous engineering fields in addition to geophysical issues of relevance. The current study might give readers a quick overview of the issues with fluid flow and heat transmission.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest among the authors.

Statement of ethical approval

The present study doesn't include any clinical trials on human beings or animals.

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