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A Brief Review on Fluid Dynamics Research

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Abstract

In this literature review paper "A Brief Review on Fluid Dynamics Research**"** the magnificent work was proposed by many researchers during the period from 1972 to 2022 is analyzed. During this span of review process, the different parameters like Diffusion Parameter, Electrification parameter, Volume fraction, Unsteady Parameter, Particle Interaction Parameter, Prandtl number, Eckert number, Grashof number etc. are used for the governing equations of the flow problem in both fluid phase and particle phase and their effects are discussed and summarized. Many numerical methods are used by different authors are investigated. Also, different real-life applications of fluid dynamics research are studied.

Keywords: Two Phase Flow, Stretching Sheet, Boundary Layer, Heat Transfer

1. Introduction

Anything which can flow is known as the term fluid. It can be imagined in our day-to-day life also inside our body. So, the study about fluid dynamics have a great role in our day to day life. The actual study about this area was begins during 250 B.C by Archimedes implementing the bouncy force. Then the progress of research in fluid dynamics is very negligible till seventeen century. On last of seventeen century the word done in this area was accelerated by Newton and Pascal. Early of eighteen century Euler and Daniel Bernoulli had given a new era to the fluid dynamics research field. In nineteen century, many research program, conferences and workshop programs were organized any many authors started writing books and papers on fluid dynamics. In latter time improvement of different numerical methods has grown the research area of fluid dynamics. The most important Navier stock equation gave a clear view of this research field. At the beginning of twentieth century i.e., on 1904 Ludwig Prandtl explained a ground breaking result on the motion of the fluid with very low friction. In this study he gave a clear idea about the boundary layer and its use for drag and streamline force.

2. Overview on Fluid Dynamics

The first ever experimental and theoretical work on fluid dynamics was conducted in 1961 by B.C Sakiadis. [1] His study was based on the boundary layer behavior of fluid on solid surface which is continuous. Later in 1970 L.J Crane [2] gave an idea about the flow of fluid over a stretching plate. He also discussed about the skin friction and heat transfer phenomena of the fluid. A study about the laminar mixed convection in a boundary layer which passed over a stretching sheet which is vertical and continuous also was made by C. H. Chen in 1998 [3] He used the finite difference method for the numerical solutions of the governing equation. He also analyzed the great effect of prandtl number and buoyancy forces on flow and heat transfer of fluid. In 1999 K. Vajravelu and T Roper [4] have studied on the flow and heat transfer phenomena on a second-grade fluid. This fluid also passed over a stretching sheet. They worked over the effect of frictional heating and deformation. The solution of the flow problem was obtained numerically and showed through graph and table. An investigation on an unsteady boundary layer flow due to a stretching sheet was made by S. Sharidan *et al.* [5]. He also used the stretching sheet velocity and surface heat flux for investigating the similarity solution. Some flow and heat transmission phenomena was determined through this study.

In another investigation M Subhas Abel *et al.* [6] have discussed about the visco-elastic boundary layer flow and heat transfer of a fluid which passed over a stretching sheet. They did the work in presence of viscous dispersion and non-uniform heat source sink also. They discussed about the effect of various parameters on wall temperature. A numerical study on heat transfer and

magneto hydrodynamic boundary layer flow phenomena of a fluid has been carried out by M Subhas Abel *et al*. [7]. They considered the fluid which passed over a flat stretching sheet with thermal conductivity and radiation. In conclusion they found that there was a great combined impact of radiation and thermal conductivity for monitoring the rate of heat transfer in boundary layer region. An analysis on 2D MHD flow of a incompressible fluid which passed over a vertical stretching sheet by A. Ishak *et al*. [8]. In conclusion they found that for increasing of magnetic parameter both skin friction and Nussetl number ware decreasing gradually. R. Tasi *et al*. [9] have shown the effect of non-uniform heat source on a flow and heat transfer of a fluid which passed by an unsteady stretching sheet. They used Chebyshev finite difference method (ChFD) for solving the governing equations after non-dimensional. As a result, they showed that the rate of heat transfer and skin friction increases with increasing of unsteady parameter. S Mukhopadhyay *et al* [10] obtained a numerical study about the effect of slip and heat transfer rate of fluid which flow over an unsteady stretching sheet. As a result, they found that flow and temperature field are mostly influenced by unsteadiness, velocity and thermal slip parameters. Kai-Long Hsiao [11] discussed the theoretical and numerical analysis of the MHD viscoelastic fluid over a stretched surface with presence of electric and magnetic dispersion. They used many numerical methods like Finite difference scheme, Newton method and Gauss Elimination for analyzing their problem. They found that the parameters like Prandtl number, and Eckert number increasing with increase of heat transfer effect but in case of magnetic field parameter it is behaves like opposite.

Dulal Pal [12] have shown the significant effect of flow and heat transfer in unsteady boundary layer flow of viscous fluid. He conducted his study on a permeable stretching sheet with presence of radiation and non-uniform heat source. As a result, he found the velocity and temperature decreases with increase of momentum boundary layer and suction parameter. In a study B.J Gireesha *et al*. [13] determined the effect of laminar boundary layer flow and heat transfer of a dusty fluid. He assumed that fluid passed over an unsteady stretching surface in presence of non-uniform heat source. He studied about the various parameters on both fluid and particle segment. He got as conclusion that the temperature profile increases with increasing of heat parameter and Eckert number but behaves oppositely with increasing of unsteady and magnetic parameter. G.K Ramesh *et al*. [14] have majorly contributed towards the study of momentum and heat transfer phenomena of the dusty fluid. The fluid is passed over an inclined stretched surface with presence of non-uniform heat source/sink. As conclusion they found that thermal boundary layer have a great effect in both increasing and decreasing of some physical parameter. This decrease with increasing of Grashof Number and Prandtl Number but performs opposite with increasing of angle of inclined and heat source/sink. C S K Raju *et al* [15] discussed about the effect of magnetic field and radiation of a MHD Nano-fluid which passed over a vertical plate. In this study they used two types of Nano fluid like Cu-Ethylene glycol and Ag-Ethylene glycol. They got as result that the magnetic field has a greater impact on mass transfer and friction factor.

In another study B.J Gireesha *et al*. [16] extended their work towards the study of two-phase flow of non-Newtonian Maxwell fluid in presence of dust particle. They discussed about the effect of thermal radiation and non-uniform heat source/sink of the fluid flow. They were concluded that buoyancy force has a positive response for momentum boundary layer but for thermal boundary layer it despite no response. Heat and mass transfer effect of MHD flow of Williamson fluid on both time dependent and independent has been studied by K. Anantha Kumar *et al*. [17] The flow of fluid considered due to the curved stretching sheet and the governing equations solved numerically by using shooting technique. Also, the results obtained in graphical and tabular form. N Datta and S K Mishra [18] have majorly contributed their knowledge towards the flow and heat transfer of a dusty fluid due fluid particle interaction. Latter P.K Tripathy *et al*. [19, 20, 21, 22, 23, 24] did the both analytic and numeric solution for two phase boundary layer flow and concluded various results as the particle have a significant role in heat transfer cases. T.N Samantara *et al*. [25, 26, 27, 28, 29, 30, 31, 32, 36] have studied about the both steady and unsteady two phase boundary layer flow and heat transfer of a fluid which passed over a stretched surface. They considered linear, inclined and horizontal stretching sheet in different works. They concluded the significant effect electrification, radiation etc. for various parameters like Prandtl number, Eckert number, magnetic field parameter, unsteady parameter, inclined angle etc. P.T Manjunath *et al*. [32] accompanied a study about the effect of radiation on flow and heat transfer of a MHD dusty flow with stretching cylinder. N. M. Sarif *et al* [33] have analyzed about the steady boundary layer flow and heat transmission over a stretched surface with boundary layer. They used Keller-box technique for solving the governing equation numerically. At the end they summarized that the thermal boundary layer is mainly depends on the Prandtl number and conjugate parameter. S Kanungo *et al*. [34, 35] have study about the numerical solution of 2-phase fluid flow which passed over a stretching sheet. They also discussed about the effect of radiation, electrification and heat transfer phenomena on the fluid flow graphically.

3. Conclusion

Go through the above-mentioned papers, it is determined that the research on fluid dynamics is a multidirectional task. It also can be extended in multi direction, considering different aspects of physical problem as well as adaptation of different methods of solution. It has huge applications at every corner world in our daily life.

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