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Progress of Research in Fluid Dynamics: A Review

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Abstract: ***This review article discusses the advancements in fluid dynamics research, focusing on the works produced by various researchers. It explores the use of different functions and parameters in the governing equations of flow problems and their effects. During the review process different functions and parameters like Diffusion Parameter, Electrification parameter, Volume fraction, Unsteady Parameter, Particle Interaction Parameter, Prandtl number, Eckert number, Grashof numberare used in governing equations of the flow problem and thee effects are studied simultaneously. The review also recognizes the diverse applications of fluid dynamics research.***

Keywords: Fluid Dynamics, Two Phase flow, Radiation, Linear Stretching Sheet, Flow Problems

1. Introduction

The first ever experimental research work on fluid dynamics was started by using the concept of buoyancy force of Archimedes in around 250 B. C. Then it progressed very sluggishly till the ninth century. In tenth and eleventh century some experimental work has been carried out in some Islamic countries with application of mathematical formula. Due to a huge research interest of Pascal, Newton and Bernoulli and many researchers, the research process on fluid dynamics was rapidly grown in seventeenth and eighteenth century. The use of several numerical methods with modern accepts in twentieth century gave a new direction to the research progress of fluid dynamics. The research works started from clear fluid to two phase flow, multi - phase flow, from Newtonian to electrification, radiation, thermal conductivity and magnetisation of flow filed with heat transfer case etc. provided a new era to fluid dynamics research.

2. Overview on Fluid Dynamics Research

In 1961 the proper theoretical and investigational work on fluid dynamics has been carried out by B. C Sakiadis. [1] His work is purely based on the boundary layer performance of fluid on a solid continuous surface. Later L. J Crane [2] produced an idea about the boundary layer flow behaviour of a fluid on a stretching surface. He also combined the heat transfer and skin friction of the fluid. C. H. Chen [3] extended the boundary layer flow with laminar mixed convection of fluid which passed through a stretching sheet. Latter many researchers have considered many physical parameters with many assumptions for research in fluid dynamics and obtained the solution. C. K Chen [4] considered the heat transfer happening in the laminar boundary layer flow on a linearly stretching sheet. He considered the study as in two cases like wall temperature and heat flux. In results the effect of many physical parameters were discussed. N. M Sarifet. al. [5] studied on the heat transfer and boundary layer flow which passed over a stretching sheet. They solved the numerical solution by using keller - box method and determined the effect of temperature and local heat transfer for different values of Prandtl numbers and conjugate parameters. In conclusion they found that the boundary thickness increases and decreases with increasing of conjugate parameter and Pr value respectively. A theoretical and numerical study of the heat and mass transfer of the exponential stretching sheet which is continuous in nature was conducted by E Magyariet. al. [6]. The mass transfer and heat transfer phenomena of boundary layers are discussed as result. H. I Anderson [7] analysed the slip - flow of a Newtonian fluid which passed over a stretching sheet which is linear. The effect of radiation on the free and force convection of a viscous incompressible fluid over a heated vertical plate has been conducted by M. A Hossain. [8] A numerical investigation about the unsteady boundary layer flow and heat transfer of a dusty fluid has been carried out by B. J Giseeshaet. al. [9, 10] They considered the flow over an exponential stretching sheet with presence of suction, thermal radiation and non - uniform heat source/sink. In another study B. J. Gireeshaet. al. [11, 12] conducted a study on the heat transfer phenomena of 3 dimensional electric conducting flow which passed over a non - linear stretching sheet with presence of thermal radiation and viscous dispersion effect. In a study Hady, F. M et. al. [13] focused on the effect of heat source sink and viscous dispersion of a viscoelastic fluid passed over a non - uniform stretching sheet. A numerical analysis of 2 - D MHD flow of electric conducting fluid over a vertical stretching sheet has been carried out by A. Ishaket. al. [14, 15]. P Durga Prasad et. Al. [16] have studied on the effect of radiation absorption and chemical reaction on MHD free convective heat and mass transfer flow of a nanofluid. The analytical solution of boundary layer flow equations were concluded as oscillatory type and then solved by perturbation technique. They have found that the decreasing of species concentration gives the increasing of suction parameter and chemical reaction. T Dash et. Al. [17] have analysed about the radiation effect of free convection flow which passed over a vertical plate. P. K Tripathy et al. [22, 23, 24, 25, 26, 27] conducted the analysis of 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. [20, 21, 28, 29, 30, 31] 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. S Kanungo et. Al. have investigated on [18, 19] two phase unsteady boundary layer flow passed over a stretching sheet with effect of electrification. . Mohammed NasirUddin et al., [32] have deliberated on unsteady mixed convective boundary layer flow of viscous fluid over a isothermal horizontal plate. P. V Satyanarayan et al., [33] have studied on the effect of heat and mass transfer on MHD oscillating fluid flow with chemical reaction and heat sources. E. O Fatunmbiet. Al. [34] have presented a study on 2 - D heat and mass transfer of an electrically conducted micro polar fluid flow with velocity and thermal slip condition which was passed on a stretching sheet. The purpose of this article is to review the progress of research in the field of fluid dynamics, examining the works produced by various researchers over a specific period and exploring the applications of fluid dynamics research.

3. Conclusion

This review highlights the multilevel and multidirectional nature of fluid dynamics research. It underscores the significant role of various physical parameters in both fluid and particle phase. It also observed that the effect of various physical parameters like viscosity, thermal conductivity, Prandlt number, Eckert Number, Reynolds number, Fluid interaction parameter, magnetic parameter, unsteady parameter etc. have a great roll in both fluid and particle phase. The review also emphasizes the extensive applications of fluid dynamics research worldwide.

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