World Journal of Advanced Research and Reviews

eISSN: 2581-9615 CODEN (USA): WJARAI

Cross Ref DOI: 10.30574/wjarr

Journal homepage: https://wjarr.com/

(Review Article)

Check for updates

Current advancements in fluid-flow Problems: A brief review

Debasish Mishra * and TN Samantara

Department of Mathematics, Centurion University of Technology and Management, Odisha 752050, India.

World Journal of Advanced Research and Reviews, 2024, 21(01), 393–398

Publication history: Received on 22 November 2023; revised on 01 January 2024; accepted on 03 January 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.21.1.2718

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; Radial Basis Function; RBF-FD Method; Meshfree and Mesh Less Method.

1. Introduction

Aldabesh et al. [1] examined the free flow of a viscous, electrically conducting fluid in the presence of a transverse magnetic field past a vertical stretched surface. This examination examines the approximate analytical method for studying the steady two-dimensional flow of viscous fluid in the presence of a magnetic field. Seth et al. [2] investigated for the unsteady MHD natural convection flow of a viscous, incompressible, electrically conducting, and heat-absorbing fluid past a vertical plate that moves impulsively and has a ramping temperature. The plate is immersed in a porous media and thermal diffusion is present. They come to the conclusion that whereas thermal diffusion and thermal buoyancy force tend to increase fluid temperature, thermal diffusion tends to decrease fluid velocity, and heat absorption has the opposite effect on it.t. Samantara et al. [3] 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. Bhukta et al. [4] was carried out analytical evaluation of energy dissipations, such as viscous, Joulian, and Darcy dissipation of viscoelastic flow phenomena over a deformable surface. The results serve as a guideline due to the process of transport properties as per the design requirement. Seth et al. [5] have discussed the effects of hall current and rotation on steady MHD Couette flow of Class-II of a viscous, incompressible and electrically conducting fluid in the presence of a uniform transverse magnetic field. Here also derived some expressions for shear stress at the lower and upper plates due to primary and secondary flows and mass flow rates in the primary and secondary flow directions. Seth et al. [6] have investigated the unsteady hydromagnetic Couette flow of a viscous, incompressible and electrically conducting fluid between two infinitely long parallel porous plates, taking hall current into account, in the presence of a transverse magnetic field. Seth at al. They have concluded that the Hall current tends to retard fluid flow in the primary flow direction throughout the channel and fluid flow in the secondary flow direction in the upper half of the channel. Magnetic field tends to accelerate fluid flow in both the primary and secondary flow directions. Samantara [7] have gone through the generation of electricity due

* Corresponding author: Debasish Mishra

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. Ray et al. [8] 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 Rungakutta 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. Pattnaik et al. [9] have considered (MHD) Nano-fluid flow (over a stretching permeable surface (using Buongiorno's Model)) where various parameters effects discussed. Mahato et al. [10] have considered MHD flow and heat transfer of nanofluid over a stretchable surface with melting, where chemical reaction effects discussed. Such nanofluid flows find applications in heat transfer processes, pharmaceutical processes, domestic refrigerators, heat exchanger, engine cooling, vehicle thermal management etc. Heat radiating, electrically conducting, incompressible, steady flow of a viscous and chemically reacting nano-fluid past a stretching sheet, with melting, in the presence of an applied transverse magnetic field, examined by Mahato et al. [11]. Das et al. [12] 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. Mishra et al. [13] 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. Pattnaik et al. [14] developed a non-Newtonian model by examine the flow of Newtonian Casson fluid over an expanding cylinder embedded in a porous medium which operate the combination of dissipative heat and the extra heat source that lift the heat transport phenomenon. They discover that the magnetic restriction and permeability enhance the shear rate coefficient, while the Casson parameter provided the contrasting influence and moreover the non-Newtonian Casson parameter hold up the fluid temperature. The impact of dissipative heat energy on the passage of an electrically conducting viscous fluid past a shrinking sheet is examined. They conclude that a higher suction is required to resist the fluid temperature and sinks as well as the dissipative heat energy favors enhancing the fluid temperature at all points in the flow domain by Acharya et al. [15]. Seth et al. [16] examined the unsteady MHD Couette flow of a viscous, incompressible and electrically conducting fluid between two parallel porous plates, taking Hall current into account, in the presence of a transverse magnetic field. They have concluded that fluid flow within the channel is induced due to accelerated movement of the lower plate of the channel and magnetic field is assumed to be fixed relative to the moving plate. Hall current tends to retard fluid flow in primary flow direction whereas it tends to accelerate fluid flow in secondary flow direction in the region near the stationary plate, also hall current tends to enhance primary shear stress at the moving plate whereas magnetic field has a reverse effect on it. Seth et al. [17] examined the effects of hall current and rotation on combined free and forced convection Couette-Hartmann flow of a viscous, incompressible and electrically conducting fluid in the presence of a uniform transverse magnetic. They have concluded that hall current and rotation tend to enhance fluid temperature, magnetic field tends to reduce fluid temperature, thermal buoyancy force tends to reduce fluid temperature when the walls of the channel are heated and it has reverse effect on fluid temperature when the walls of the channel are cooled. Thermal diffusion tends to reduce fluid temperature whereas viscous dissipation has reverse effect on it. Magnetic field and rotation tend to enhance both the primary and secondary shear stress at the moving plate. Tripathy et al. [18] 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. [19] 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. Jena et al. [20] enlarged a mathematical model and a survey made for flow of Casson fluid a non-Newtonian model over a cylinder in a porous medium. They conclude that Casson fluid parameter improved cutis friction coefficient yet slow up momentum and temperature distributions also Nusselt number. Jena et al. [21] scrutinized the steady boundary layer MHD stagnation- point flow past a stretching sheet through porous media with heat source /sink. They conclude that the existence of magnetic field produces a Lorentz force of electromagnetic origin, which is a drag force, hence the velocity decreases. Mahatha et al. [22] have considered MHD stagnation point nanofluid flow over a stretchable melting surface where thermal radiation, chemical reaction, viscous and Joule dissipative effects discussed. Various type of heat transfer processes, heat exchangers, engine cooling, vehicle thermal management etc. are the applications of these nano-fluid flows. Mahatha et al. [23] have considered MHD stagnation point nano-fluid flow (Over a stretchable melting surface) where radiation and dissipative effects examined. They concluded that velocity of nanofluid increased by radiation, velocity ratio parameter and magnetic field and decreased by thermal diffusion, thermophoretic diffusion, Brownian diffusion, viscous dissipation and melting of the sheet. Mishra et al. [24] 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. [25] 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. Recently, Mahato et al. [26] studied "Radiative and Convective Heat Transfer on MHD Stagnation point Nanofluid Flow past a Stretchable Surface with Melting". In the presence of thermal stratification, the impact of thermal radiation and Joule heating due to the magnetohydrodynamic (MHD) flow of nanofluid against a nonlinearly stretching sheet with variable thickness are investigated by Pattnaik et al. [27]. Samantara et al. [28] 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. Qasim et al. [29] examined about mass and heat transfer in nanofluid over an unsteady stretching sheet using Buongiorno's model, where the Nusselt number is increased the temperature at the surface decreases with the Prandtl number. By increasing the Prandtl number the thermal limit layer thickness decreases. The axial velocity is strong in the hydromagnetic boundary layer while the magnetic field is absent, and vice versa. Mahanthesh et al. [30] investigated MHD three-dimensional flow of nanofluids with slip and thermal radiation over a nonlinear stretching sheet. For the influence of mixed convection, the response of x- and y-components at the momentum boundary layer thickness is qualitatively opposite. Temperature at the boundary layer decreases with an increase in the mixed convection parameter. Transverse velocities and influence on axial of stretching ratio parameter is opposite. Verma et al. [31] have examined numerically a steady 2-D viscous Cu-water and Ag-Water nanofluid in a porous medium. A mathematical model and calculation to analyze simultaneously 3-models for rate of viscous flow, heat transfer including other effects has been studied in this problem. N.B Barik et.al[32] have studied Meshfree Multilevel Iterative Algorithm for Navier-Stokes Equations. The algorithm provides a new strategy to get good order of accuracy with less computational time, which is most important in the present world. The main idea is the layer-by-layer calculation and then layer-by-layer correction from coarsest level to finest level node points. The developed scheme saves at least 60% of CPU time for Poisson equation and 59% of the CPU time for Navier–Stokes equation than the usual local RBF method. The iteration matrix of the proposed local RBF method satisfies the necessary and sufficient condition for convergence. K.K. Patra et.al[33] have discussed an evolution equation for the free-surface dynamics of a thin film of a second-grade fluid over an unsteady stretching sheet using long-wave theory. For the numerical investigation of the viscoelastic effect on the thin-film dynamics, a finite volume approach on a uniform grid with implicit flux discretization is applied. It concludes that the fluid thins faster with the rapid stretching rate of the sheet, but the second-grade parameter delays the thinning behaviour of the liquid film. N.B Barik et.al[34] have studied Accommodative FAS-FMG Multilevel Based Meshfree Augmented RBF-FD Method for Navier-Stokes Equations in Spherical Geometry. The efficiency of any numerical scheme measures the accuracy of the scheme and its computational time. An efficient meshfree augmented local radial basis function (RBF-FD) method has been developed for steady incompressible Navier-Stokes equations in spherical geometry with unbounded domain which is based on accommodative FAS-FMG multigrid method. The developed scheme saves around 34% of the CPU time than the usual RBF-FD method. K.K. Patra et.al[35] have studied a typical feature of a thin viscous or viscoelastic fluid is the formation of the capillary ridges over locally heated plates. This work particularly concerned the flow of non-Newtonian third-grade fluid over an inclined heated plate and the formation of ridges. It concludes how the third-grade viscoelastic parameters affect the dynamics of the free surface and the size of the capillary ridge concerning temperature changes and other phenomena of interest. N.B Barik et.al[36] have gone through An Efficient Local RBF Meshless Scheme for Steady Convection–Diffusion Problems. The efficiency of any numerical scheme measures on the accuracy of the scheme and its computational time. In this work, an efficient augmented local radial basis function finite difference (RBF-FD) scheme has been developed for steady convection–diffusion problems. The developed scheme saves 70– 80% of the CPU time for the first two model problems and at least 50% of the CPU time for NS equations than the usual RBF-FD method found in the literature. Samantara TN et.al[37]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 RungeKutta 4th order technique.

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 are several 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.

References

[1] Aldabesh AD, Pattnaik PK, Jena S, Mishra SR, Henda M and Tlili I. Free convection of a viscous electrically conducting fluid past a stretching surface. Fluid Dynamics & Materials Processing. 2022; 18 (2): 205-222.

[2] Seth GS, Sarkar S and Mahato GK. Numerical solution of unsteady hydromagnetic natural convection flow of heat absorbing fluid past an impulsively moving vertical plate with ramped temperature. International Journal of Applied Mathematical Research. 2013; 2 (2): 317-324. DOI: https://doi.org/10.14419/ijamr.v2i2.939

[3] Samantara TN, Mishra SK and Panda TC. Flow and heat transfer in a laminar two-phase plane wall jet. Int. J. Eng. Trends Technol. 2013; 4 (8): 3434-3447.

[4] Bhukta D, Dash GC, Mishra SR and Jena S. Analytical estimation of energy dissipations: Viscous, Joulian, and Darcy of viscoelastic fluid flow phenomena over a deformable surface. Heat Transfer. 2021; 50 (8): 7798-7816.

[5] Seth GS, Mahato GK and Singh JK. Effects of Hall current and rotation on MHD Couette flow of class-II. Journal of International Academy of Physical Sciences. 2011; 15 (5) Special Issue-1: 213-230.

[6] Seth GS, Singh JK and Mahato GK. Unsteady hydromagnetic Couette flow within a porous channel with Hall effects. International Journal of Engineering. Science and Technology. 2011; 3 (6): 172-183. DOI: 10.4314/ijest.v3i6.14

[7] Samantara T. Velocity profile of fluid particle suspension over a horizontal plate with electrification of particles. International Journal of Innovative Technology and Exploring Engineering, 2019; 8(11): 1119–1122. DOI: 10.35940/ijitee.J1220.0981119

[8] Ray S, Samantara T and Siddique M. Study of effects of radiation on heat transfer of two phase boundary layer flow over a stretching sheet. International Journal on Emerging Technologies. 2019; 10 (2b): 203-207.

[9] Pattnaik PK, Jena S, Mishra N and Lenka S. Using Buongiorno's model Buoyancy effect on nano-fluid flow induced by a stretching permeable surface. TEST Eng Manag. 2020; 83: 14365-14370.

[10] Mahato GK, Mahatha BK, Nandkeolyar R and Patra B. The effects of chemical reaction on magnetohydrodynamic flow and heat transfer of a nanofluid past a stretchable surface with melting. AIP Conference Proceedings. 2020; 2253 (1), 020011-1–020011-13. DOI: https://doi.org/10.1063/5.0019205 , ISBN: 978-0-7354-2012-0

[11] Mahato GK, Mahatha BK and Samal S. Melting Heat Transfer on Magneto- hydrodynamic (MHD) Flow of a Heat Radiating and Chemically Reacting Nano-Fluid past a Stretchable Surface. JP Journal of Heat and Mass Transfer. 2019; 17 (2): 379-398. DOI: http://dx.doi.org/10.17654/HM017020379

[12] Das T, Samantara T and Sahu SK. Radiation Effects on the Unsteady MHD Free Convection Flow Past in an Infinite Vertical Plate with Heat Source. International Journal of Mathematical and Computational Sciences. 2020; 14 (6): 61-66.

[13] Mishra J and Samantara T. Study of Unsteady Two Phase Flow over An Inclined Permeable Stretching Sheet with Effects of Electrification and Radiation. Journal of Advanced Research in Fluid Mechanics and Thermal Sciences. 2022; 97(2): 26–38. DOI: https://doi.org/10.37934/arfmts.97.2.2638

[14] Pattnaik PK, Mishra S and Jena S. Dissipative heat for the Casson fluid flow past an expanding cylindrical surface. Heat Transfer. 2022; 51(3): 2476-2487.

[15] Acharya S, Nayak B, Mishra SR and Jena S. Adomian decomposition method for the MHD flow of a viscous fluid with the influence of dissipative heat energy. Heat Transfer. 2020; 47(8): 4612-4625.

[16] Seth GS, Singh JK and Mahato GK. Hall effects on unsteady magnetohydrodynamic Couette flow within a porous channel due to accelerated movement of one of its plates. Journal of Nature Science and Sustainable Technology. 2013; 7 (3): 271-290.

[17] Seth GS, Mahato GK and Singh JK. Combined Free and Forced Convection Couette-Hartmann Flow in a Rotating System with Hall Effects. Journal of Nature Science and Sustainable Technology. 2012; 6 (3): 125-150.

[18] Tripathy PK, Samantara T, Mishra J and Panda S. Mixed convective radiative heat transfer in a particle-laden boundary layer fluid over an exponentially stretching permeable surface. AIP Conference Proceedings. 2022; 2435: 020030. DOI: https://doi.org/10.1063/5.0083840

[19] Kanungo S and Samantara T. Numerical Solution of Two-Phase Radiated Unsteady Flow Over a Horizontal Stretching Sheet with Simultaneous Effect of Electrification, Radiation and Non-Uniform Internal Heat Source/Sink. Journal of Advanced Research in Fluid Mechanics and Thermal Sciences. 2022; 100 (3): 11-22. DOI: https://doi.org/10.37934/arfmts.100.3.1122

[20] Jena S, Mishra SR, Aghaeiboorkheili ., Pattnaik PK and Muduli K. Impact of Newtonian heating on the conducting Casson fluid flow past a stretching cylinder. Journal of Interdisciplinary Mathematics. 2022; 25(8): 2401-2416.

[21] Jena S and Mishra SR. MHD stagnation-point flow past a stretching sheet through porous media with heat source/sink. International Journals of Engineering, Science & Mathematics. 2017; 6(8).

[22] Mahatha BK, Padhi SB, Mahato GK and Ram S. Radiation, chemical reaction and dissipative effects on MHD stagnation point nano-fluid flow past a stretchable melting surface. AIP Conference Proceedings. 2022; 2435 (1), 020040-1–020040-19. DOI: https://doi.org/10.1063/5.0083933, ISBN: 978-0-7354-4177-4

[23] Mahatha BK, Mahato GK, Gifty GP and Padhi SB. Radiation and Dissipative Effects on MHD Stagnation Point Nano-Fluid Flow past a Stretchable Melting Surface. TEST Engineering & Management. 2020; 83: 14107 – 14117.

[24] Mishra J and Samantara T. Effect of Radiation and Non-Uniform Heat Source/Sink on Flow over a Linear Stretching Sheet with Fluid Particle Suspension. CFD Letters. 2023; 15 (6): 42-53. DOI: https://doi.org/10.37934/cfdl.15.6.4253

[25] Kanungo S and Samantara T. Flow And Heat Transfer of Unsteady Two-Phase Boundary Layer Flow Past an Inclined Permeable Stretching Sheet with Electrification of Particles. CFD Letters. 2023; 15 (5): 134-144. DOI: https://doi.org/10.37934/cfdl.15.5.134144

[26] Mahato GK, Mahatha BK, Ram S and Padhi SB. Radiative and Convective Heat Transfer on MHD Stagnation point Nanofluid Flow past a Stretchable Surface with Melting. AIP Conference Proceedings. 2022; 2435 (1): 020037-1–020037-19. DOI: https://doi.org/10.1063/5.0083936, ISBN: 978-0-7354-4177-4.

[27] Pattnaik PK, Jena S and Mishra N. Effects of thermal stratification on MHD radiative nanofluid flow over nonlinear stretching sheet. EPRA International Journal of Research and Development. 2018; 3(11): 142-155.

[28] Samantara T, Mishra SK and Panda TC. Numerical modeling of two phase jet flow and heat transfer with charged suspended particulate matter (SPM), Modelling. Measurement and Control B. 2017; 86(4): 885–906. DOI: 10.18280/mmc_b.860405

[29] Qasim M, Khan ZH, Lopez RJ and Khan WA. Heat and mass transfer in nanofluid thin film over an unsteady stretching sheet using Buongiorno ‘s model. Eur. Phys. J. Plus. 2016; 131: 16.

[30] Mahanthesh B, Gireesha BJ, Gorla RSR and Makinde OD. Magnetohydrodynamic three-dimensional flow of nanofluids with slip and thermal radiation over a nonlinear stretching sheet: a numerical study. Neural Comput & Applic. 2018; 30: 1557–1567.

[31] Verma AK, Gautam AK, Bhattacharyya K, Sharma RP. Existence of boundary layer nanofluid flow through a divergent channel in porous medium with mass suction/injection. Sadhana. 2021; 46: 1-10.

[32] Barik Nikunja Bihari, Sekhar TVS. Meshfree Multilevel Iterative Algorithm for Navier-Stokes Equations. An International Journal of Computation and Methodology.2020:150-164.https://doi.org/10.1080/10407790.2020.1803611

[33] Panda S, Patra K.K and Sellier M. Free-surface dynamics of thin second-grade fluid over an unsteady stretching sheets. ANZIAM journal. 2018; 60: 249–268DOI:10.1017/S1446181118000251.

[34] Barik NB and Sekhar TVS, Accommodative FAS-FMG multilevel based meshfree augmented RBF-FD method for Navier–Stokes equations in spherical geometry, mathematics, and computing, ICMC 2017; Common. Compute. Inform. Sci.; vol. 655: pp. 141–151. https://doi.org/10.1007/978-981-10-4642-1_13

[35] T Sherin Jose, Patra Kiran Kumar and Panda S. Modeling and simulation of capillary ridges on the free surface dynamics of third-grade fluid. Journal Zeitschrift für Naturforschung A. 2021; 76(3)a: 217–229.https://doi.org/10.1515/zna-2020-0225

[36] Barik N.B., Sekhar T.V.S. An efficient local RBF meshless scheme for steady convection-diffusion problems. Int. J. Compute. Methods. 2017 ;14(06):1750064 DOI:10.1142/S0219876217500645

[37] Mishra Jayaprakash, Samantara Tumbanath, Tripathy Pradeep Kumar .Effects of Electrification and Transverse Force on Dusty Flow over a Linear Stretching Sheet. CFD Letters. 2023; 2(2024): 151-161.DOI: https://doi.org/10.37934/cfdl.16.2.151161