Analytical study of Inter-Particle Spacing and Nanoparticle Radius due to the Water-Based Copper Nanofluid Flow past a Rotating Disk

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Abstract: The study of nanofluid flow over a rotating disk has significant importance because of its enormous range of implementations, including cancer treatments, chemotherapy, nanomedicines, fermentation sciences, selective drug delivery, food sciences, etc. Due to these applications of nanofluid, the present problem investigates the MHD flow of nanofluid with nonlinear thermal radiation and viscous dissipation. In this analysis, the aluminum oxide nanoparticles are mixed with water. Further, the mechanism for inter-particle spacing and radius of aluminum oxide nanoparticles on the dynamics of the two-dimensional flow of nanofluid is investigated. The analytical solution to the current modeled problem has been obtained by using the homotopy analysis technique.

Introduction

The mixture of nano-sized particles (nanoparticles) suspended in a base liquid is known as nanofluid. Nanofluid is used for the improvement of the rate of heat transmission and its thermal conductivity is higher compared to the base liquid. Nanofluids are used in several manufacturing and engineering fields. So, the applications of nanofluids are vehicle thermal management, fuel cells, hybrid-powered engines, refrigerators, microelectronics, heat transfer, engine cooling, etc. Due to these applications, many investigators used the phenomena of nanofluid in their field of study. Shamshuddin and R. Ed [1] examined the mixed convection flow of water-based silver, copper, and gold nanoparticles with the Joule heating effect under the stretched surface. Tayyab et al. [2] deliberated the upshot of the magnetic field over the rotating flow of nanoliquid

Results and Discussion

The major findings and principal results of this investigation are concluded that the primary velocity of nanoliquid is augmented due to the intensification in suction parameter for both the small and larger radius of aluminum oxide nanoparticles. Furthermore, it is perceived that the heat rate transfer is larger when the Eckert number and nanoparticle volume fraction are higher for both nonlinear and linear thermal radiation cases.

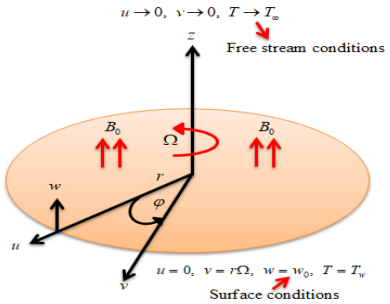

Figure 1: Physical representation of the problem.

References

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[3] Ramzan, M., Rehman, S., Junaid, M. S., Saeed, A., Kumam, P., & Watthayu, W. (2022). Dynamics of Williamson Ferro-nanofluid due to bioconvection in the portfolio of magnetic dipole and activation energy over a stretching sheet. *Int. Commun. Heat Mass Transf* **137**, 106245.