Documents

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Analytical and numerical investigation of fe 3 o 4 -water nanofluid flow over a moveable plane in a parallel stream with high suction

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Abstract
In the current framework, a model is constituted to explore the impacts of high suction and partial slip on Fe 3 O 4 -water nanoliquid flow over a porous moveable surface in a parallel free stream. The mechanisms of heat transfer are also modeled in the existence of Newtonian heating effect. The obtaining PDEs are transformed into a non-linear ODE system employing appropriate boundary conditions to diverse physical parameters. The governing ODE system is solved using a singular perturbation technique that results in an analytical asymptotic solution as a function of the physical parameters. The obtained solution allows us to carry out an analytical parametric study to investigate the impact of the physical parameters on the nonlinear attitude of the system. The precision of the proposed method is verified by comparisons between the numerical and analytical results. The results confirm that the proposed technique yields a good approximation to the solution as well as the solution calculation has no CPU time-consuming or round off error. Numerical solutions are computed and clarified in graphs for the model embedded parameters. Moreover, profiles of the skin friction coefficient and the heat transfer rate are also portrayed and deliberated. The data manifests that both solid volume fraction and slip impact significantly alter the flow profiles. Moreover, an upward trend in temperature is anticipated for enhancing Newtonian heating strength. Additionally, it was found that both the nanofluid velocity and temperature distributions are decelerated when the solid volume fraction and suction parameters increase. Furthermore, a rise in slip parameter causes an increment in velocity profiles, and a rise in Biot number causes an increment in the temperature profiles. © 2019 by the authors.

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