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Sensitivity analysis of heat and mass transfer of hybrid nanofluid flow between two parallel Riga plates with non-uniform heat absorption/generation and chemical reaction

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ABSTRACT

Hybrid nanofluids have piqued the interest of scholars and scientists in the current technological age due to their increased thermophysical properties and the urge to achieve higher heat transfer rates when compared to conventional fluids. Hence the current study analyzes the impact of the porous medium, non-uniform heat source/sink, and chemical reaction over a hybrid nanofluid flow with convective boundary conditions. Flow is theoretically unstable, squeezing the laminar flow of hybrid nanofluid through infinite parallel plates. The transport analysis of heat and mass is investigated by using response surface methodology (RSM) and estimating the sensitivity of the heat transfer rate to the effective parameters: squeeze number, space-dependent and temperature heat absorption/generation, and reaction rate parameters. Suitable similarity transformations are applied to the mathematical model formed to convert governing partial differential equations to ordinary differential equations (ODEs). The bvp-4c numerical method is used to tackle complex boundary value issues. The effects of numerous elements on corresponding profiles of the problem are examined and graphically shown based on numerical findings obtained with bvp-4c. The bvp-4c is a simple, robust, and accurate method for dealing with various boundary value problems. Its residual-based error control and collocation formulation are superior to simpler techniques. According to the study, skin friction reduces for larger values of Hartman number. The rate of heat transfer decreases upon rising squeezing number and for augmented values of reaction rate parameter, enhanced mass transfer was found. These outcomes have various applications in electronics cooling, waste heat recovery, heat exchangers, and energy systems.

REFERENCES

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