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Heat and mass transfer characteristics of MHD three-dimensional flow over a stretching sheet filled with water-based alumina nanofluid
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Abstract
Purpose: This paper aims to understand the influence of velocity slip, nanoparticle volume fraction, chemical reaction and non-linear thermal radiation on MHD three-dimensional heat and mass transfer boundary layer flow over a stretching sheet filled with water-based alumina nanofluid. To get more meaningful results, the authors have taken nonlinear thermal radiation in the heat transfer process. Design/methodology/approach: Suitable similarity variables are introduced to convert governing partial differential equations into the set of ordinary differential equations, and are solved numerically using a versatile, extensively validated finite element method with Galerkin's weighted residual simulation. The velocity, temperature and concentration profiles of nanoparticles as well as skin friction coefficient, Nusselt number and Sherwood number for different non-dimensional parameters such as volume fraction, magnetic, radiation and velocity slip parameters as well as the Prandtl number are examined in detail, and are presented through plots and tables. Findings: It is noticed that the rate of heat transfer enhances with higher values of nanoparticle volume fraction parameter. It is worth mentioning that the heat transfer rates improve as the values of increase. Increasing values of M, R, θw and β decelerates the thickness of the thermal boundary layer in the fluid regime. The heat transfer rates decelerate as the values of suction parameter increase. Originality/value: The authors have written this paper based on the best of their knowledge on heat and mass transfer analysis of nanofluids. The information in this paper is new and not copied from any other sources. © 2018, Emerald Publishing Limited.

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