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Entropy generation analysis for radiative heat transfer to Bödewadt slip flow subject to strong wall suction

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Abstract: Similarity solutions are found for radiative heat transfer in Bödewadt slip flow past rough disk subjected to wall suction. The idea of non-linear thermal radiation for the Bödewadt boundary layer is just introduced here. An early study determined that a physically plausible solution of the energy equation fails to exist as long as the surface is impermeable. By using von-Kármán transformations, the relevant equations are changed into locally similar forms and then numerical solutions are constructed for broad range of embedded parameters. Our calculations show remarkable effects of fluid suction and slip coefficients on the solution profiles. Stability of the solutions is checked by computing lowest eigenvalues of the governing boundary value problem. Fluid temperature is highly sensitive to a parameter θ_w measuring the importance of wall temperature relative to ambient temperature. Interesting implications of this parameter on the underlying flow physics are clarified. Analysis of entropy generation for the Bödewadt's boundary layer is carried out in the existence of new physical mechanism, namely non-linear radiation in this research. The paper also aims to deduce the behaviors of slip coefficients and temperature ratio parameter on the heat transfer rate, which has definite role in many heat transfer applications.

Keywords: Bödewadt flow; Rotating flow; Partial slip; Entropy generation; Thermal radiation

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