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Magnetohydrodynamics Flow and Heat Transfer in a Non-Newtonian Power-Law Fluid due to a Rotating Disk with Velocity Slip and Temperature Jump

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Abstract : Swirling flows with velocity slip are important in nature and industrial processes. The present work considers the effects of velocity slip, temperature jump and suction/injection on the flow and heat transfer of power-law fluids due to a rotating disk in the presence of magnetic field. The system of the partial differential equations is highly non-linear. The number of independent variables is reduced by transforming the system into a system of coupled non-linear ordinary differential equations using similarity transformations. The effects of suction/injection, velocity slip and temperature jump on the flow rates are investigated for various cases of shear thinning and shear thickening power law fluids. The thermal and velocity jump strongly reduce the heat transfer rate and skin friction coefficient. Suction decreases the radial and tangential skin friction coefficient and the rate of heat transfer. It is also observed that the effects are more pronounced in the case of shear thinning fluids as compared to shear thickening fluids.

Keywords : heat transfer, power-law fluids, rotating disk, suction or injection, temperature jump, velocity slip
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