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MHD mixed convection from a horizontal circular cylinder

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Abstract: This work investigates analytically the effect of a radial magnetic field on the flow and heat transfer characteristics of mixed convection from a horizontal circular cylinder. Variable wall temperature is assumed at the cylinder surface. Two sets of transformations are used, one for forced-convection-dominated flow and the other for buoyancy-convection-dominated flow. The results are obtained numerically using the local nonsimilarity method and the coordinate perturbation method. The variation of local wall shear stress and local heat transfer along the circumference up to the point of separation and the velocity and temperature profiles in the boundary layer are obtained for varying values of the magnetic parameter (Ha2/Re) and the buoyancy parameter (Gr/Re2), which covers the entire regime of mixed convection from the pure forced convection to the pure free convection. It is found that the presence as well as the increase in the magnetic field leads to a decrease in the velocity field, local wall shear stress, and local Nusselt number and a rise in the values of temperature in the flow field.