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| Abstract |  |
| A mathematical model is presented for laminar, steady natural convection mass transfer in boundary layer flow from a rotating porous vertical cone in anisotropic high-permeability porous media. The transformed boundary value problem is solved subject to prescribed surface and free stream boundary conditions with a Maple 17 shooting method. Validation with a Chebyshev spectral collocation method is included. The influence of tangential Darcy number, swirl Darcy number, Schmidt number, rotational parameter, momentum (velocity slip), mass slip and wall mass flux (transpiration) on the velocity and concentration distributions is evaluated in detail. The computations show that tangential and swirl velocities are enhanced generally with increasing permeability functions (i.e., Darcy parameters). Increasing spin velocity of the cone accelerates the tangential flow, whereas it retards the swirl flow. An elevation in wall suction depresses both tangential and swirl flow. However, increasing injection generates acceleration in the tangential and swirl flow. With greater momentum (hydrodynamic) slip, both tangential and swirl flows are accelerated. Concentration values and Sherwood number function values are also enhanced with momentum slip, although this is only achieved for the case of wall injection. A substantial suppression in tangential velocity is induced with higher mass (solutal) slip effect for any value of injection parameter. Concentration is also depressed at the wall (cone surface) with an increase in mass slip parameter, irrespective of whether injection or suction is present. The model is relevant to spin coating operations in filtration media (in which swirling boundary layers can be controlled with porous media to deposit thin films on industrial components), flow control of mixing devices in distillation processes and also chromatographical analysis systems. | |