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A Theoretical Study of Magnetic Pressure Driven Flow in a Narrow Channel O.R.E. PAZ Y PUENTE, Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México, H.L.G. COUTO, Departamento de Engenharia Mecânica, Universidade de Brasília, R. ZENIT, Instituto de Investigaciones en Materiales, UNAM, F.R. CUNHA, Departamento de Engenharia Mecânica, UnB
— Shape and height of a ferrofluid meniscus in a narrow channel composed of two vertical flat plates in response to a vertical, spatially oscillatory, magnetic field are theoretically studied. The formulation is based on an extension of the Young-Laplace equation combined with the mean curvature equation for a two-dimensional free surface. The formulation results in a hydrodynamic-magnetic problem governed by a nonlinear second order differential equation. According to this formulation, there are two relevant physical parameters in the equation: the gravitational Bond number and a new parameter: the magnetic Bond number. To solve the equation, an adaptive integration step, fourth order Runge-Kutta coupled with a Secant method is used. This procedure accelerates the convergence of a solution by checking if the boundary condition associated with the contact angle is satisfied. Influence of the magnetic Bond number on the height and shape of the ferrofluid column is evaluated for different oscillation regimes of the magnetic field. Results indicate that it is possible to make the fluid column rise even in the absence of common surface tension capillary effects.

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