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201419th Australasian Fluid Mechanics Conference, AFMC 2014; Melbourne; Australia; 8 December
2014 through 11 December 2014; Code 117805Quasi-two-dimensional MHD duct flow around a 180-degree sharp bend
in a strong magnetic field (Conference Paper)Sapardi, A.M.^{a,b}, Hussam, W.K.^a, Pothérat, A.^c, Sheard, G.J.^a^aSheard Lab., Department of Mechanical and Aerospace Engineering, Monash University, VIC 3800, Australia^bDepartment of Mechanical Engineering, International Islamic University Malaysia, Kuala Lumpur, 53300, Malaysia^cApplied Mathematics Research Centre, Coventry University, Coventry, CV1 5FB, United Kingdom

Abstract

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This study considers the quasi-two-dimensional flow of an electrically conducting fluid subjected to a strong out-of-plane magnetic field in a rectangular duct. The effect of Hartmann number on flow features such as the length of the downstream recirculation bubbles and the threshold Reynolds numbers between steady-state and unsteady flow regimes for values of the ratio between the throat of the bend and the duct height, $\beta = 1$ are identified. The simulations reveal that the primary recirculation bubble length decreases with increasing Hartmann number, and simultaneously the secondary recirculation bubble is significantly damped compared to the corresponding non-MHD case. The critical Reynolds number where the transitions from steady to unsteady flow occurs was found to increase with increasing of Hartman number. This study provides information that will be useful for refining the design of heat exchanger ducting in MHD systems to maximise the useful mass transport adjacent to the duct walls where heating is applied.

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