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Mixed convection in liquid metal flow in a horizontal duct with strong axial magnetic field[1] XUAN ZHANG, OLEG ZIKANOV, University of Michigan - Dearborn — The work is motivated by design of self-cooled liquid-metal breeder blankets for Tokamak fusion reactors. Thermal convection caused by non-uniform internal heating in a liquid metal flow in a horizontal duct with strong axial magnetic field is analyzed numerically. Axial magnetic field is considered strong enough (the Hartmann number up to 10^4 corresponding to typical reactor condition) to suppress the streamwise variation of the flow, so a two-dimensional fully developed flow is studied. Duct walls are assumed to be thermally and electrically insulated. The non-uniform internal heat deposited by captured neutrons is fully diverted by the mean flow. Realistically high Grashof (up to 10^{11}) and Reynolds (up to 10^6) numbers are considered. It is found that the state of the flow is strongly affected by the vertical stable stratification developing in response to the streamwise growth of mean temperature. Two flow regimes are identified: the regime with developed transverse convection at moderate Grashof numbers, and the regime, in which convection is suppressed at high Grashof numbers.

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