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Natural Convection in a Slot Subject to a Spatially Distributed Heating M.Z. HOSSAIN, JERZY M. FLORYAN, University of Western Ontario — Natural convection in a fluid contained in an infinite horizontal slot subject to a spatially distributed heating has been investigated for a wide range of Prandtl numbers Pr. Detailed results are presented for the case of the lower wall subject to heating being a sinusoidal function of one of the coordinate, with its spatial distribution described by the heating wave number α and its intensity expressed in terms of the Rayleigh number Ra. The primary response of the system, which represents a forced response, consists of convection in the form of rolls whose structure is determined by the particular values of Ra and α. Linear stability of convective motion has been considered and conditions leading to the emergence of roll instability have been identified. Two mechanisms of instability motion at the onset have been identified. In the case of moderate α the pattern of instability is generally locked-in with the pattern of heating according to the relation $\delta_{cr} = \alpha/2$. In the case of large α, the critical disturbance wave number approaches value $\delta_{cr} = 1.56$ and the fluid response is similar to that found in the case of a uniformly heated wall. The first mechanism dominates if the spatial modulation of the flow is sufficiently strong while the second one dominates in the case of weak spatial modulation.

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