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Natural Convection Due to a Long Wavelength Heating ALI ASGARIAN, MOHAMMED Z. HOSSAIN, JERZY M. FLORYAN, University of Western Ontario — Natural convection in an infinite horizontal layer subject to a spatially periodic heating is considered. The analysis is focused on the heating wave number $\alpha \to 0$. It has been shown that convection has a simple topology consisting of one pair of counter-rotating rolls per heating period when the heating intensity does not exceed the critical value of the Rayleigh number $\mathrm{Ra} = 427$. Secondary motions in the form of rolls aligned in the direction of the primary rolls and concentrated around the hot spots occur for more intense heating. When $427<\mathrm{Ra}<470$ the secondary motions are described by supercritical pitchfork bifurcations and can occur only if α is reduced below 0.14. One of the branches of such bifurcations is associated with an odd number of secondary rolls per half period, with rolls at the hot spots rotating in the direction opposite to the primary rolls. The other branch is associated with an even number of secondary rolls per half period, with the rolls at the hot spots co-rotating with the primary rolls. The number of rolls increases without limit as α decreases with new rolls being pinched off in pairs. Increase of heating intensity to $\mathrm{Ra}>470$ results in secondary motions occurring at larger values of α, i.e., $\alpha > 0.14$, and bifurcation changing character into "bifurcations from infinity." It is shown that the observed phenomena are strictly associated with the small wave number limit of the external heating.

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