

Abstract Submitted  
for the DFD13 Meeting of  
The American Physical Society

**Instabilities of Natural Convection in a Periodically Heated Layer**

M.Z. HOSSAIN, JERZY M. FLORYAN, University of Western Ontario — Natural convection in a horizontal layer subject to a spatially periodic heating along the lower wall has been investigated. The heating produces sinusoidal temperature variations characterized by the wave number  $\alpha$  and the Rayleigh number  $Ra_p$ . The primary response has the form of stationary rolls with axis orthogonal to the heating wave vector. For large  $\alpha$  convection is limited to a thin layer adjacent to the lower wall with a uniform conduction above it. Linear stability was used to determine conditions leading to a secondary convection. Two mechanisms of instability have been identified. For  $\alpha = O(1)$ , the parametric resonance dominates and leads to the pattern of instability that is locked-in with the pattern of the heating according to the relation  $\delta_{cr} = \alpha/2$ , where  $\delta_{cr}$  denotes the component of the critical disturbance wave vector parallel to the heating wave vector. The second mechanism, Rayleigh-Bénard (RB) mechanism, dominates for large  $\alpha$ . Competition between these mechanisms gives rise to non-commensurable states and appearance of soliton lattices, to the formation of distorted transverse rolls, and to the appearance of the wave vector component in the direction perpendicular to the forcing direction.

Jerzy M. Floryan  
University of Western Ontario

Date submitted: 02 Aug 2013

Electronic form version 1.4