On the unsteady Benard – Marangoni problem ITZCHAK FRANKEL, MICHAEL WEIDENFELD, Technion - Israel Institute of Technology — The Benard – Marangoni instability originating from the coupling between a non-uniform liquid – surface temperature and convection across a favorable temperature gradient is a classic problem in hydrodynamic stability theory. We study the linear temporal stability problem focusing on short times when perturbations evolve on the background of a non-linear unsteady temperature distribution across the liquid layer. Accordingly, we analyze the initial – value (rather than the standard eigenvalue) problem and obtain a Volterra – type integral equation governing the evolution of perturbations. The results indicate that the onset of convection at short times is effectively confined to the narrow thermal boundary layer developing next to the liquid surface and is dominated by short – wavelength perturbations. Increasing the Prandtl number is found to be destabilizing.

Itzchak Frankel
Technion - Israel Institute of Technology