Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Feedback control of Marangoni instability in a thin film[1] ANNA SAMOILOVA, ALEXANDER NEPOMNYASHCHY, Technion - Israel Institute of Technology — We use the feedback control for the suppression of Marangoni instability in a thin film heated from below. Our keen interest is focused on the oscillatory mode that was recently revealed in the case of the thermally insulated substrate. We apply the lubrication approximation to derive nonlinear amplitude equations which govern the coupled evolution of the layer thickness and the characteristic temperature. To stabilize the no-motion state of the film we apply the linear feedback control. The principle of such control is that we feed the information about instability back into the dynamics by changing the heat flux through the substrate that can affect the instability. Linear analysis shows that the control of the temperature deviation at the deformable free surface stabilizes the thin film heated from below effectively. To render the subcritical instability supercritical we apply the quadratic feedback control. The weakly nonlinear analysis of the amplitude equations is provided for two types of regime: a pair of the travelling waves and a pair of the standing waves. The conditions of stable supercritical solutions are obtained for both types of regime.

[1]This research was supported by the Israel Science Foundation (grant No. 843/18)

Anna Samoilova
Technion - Israel Institute of Technology

Date submitted: 29 Jul 2019 Electronic form version 1.4