

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Control of three-dimensional waves on thin liquid films. I - Optimal control and transverse mode effects RUBEN TOMLIN, SUSANA GOMES, GREG PAVLIOTIS, DEMETRIOS PAPAGEORGIOU, Imperial College London — We consider a weakly nonlinear model for interfacial waves on three-dimensional thin films on inclined flat planes – the Kuramoto—Sivashinsky equation. The flow is driven by gravity, and is allowed to be overlying or hanging on the flat substrate. Blowing and suction controls are applied at the substrate surface. In this talk we explore the instability of the transverse modes for hanging arrangements, which are unbounded and grow exponentially. The structure of the equations allows us to construct optimal transverse controls analytically to prevent this transverse growth. In this case and the case of an overlying film, we additionally study the influence of controlling to non-trivial transverse states on the streamwise and mixed mode dynamics. Finally, we solve the full optimal control problem by deriving the first order necessary conditions for existence of an optimal control, and solving these numerically using the forward—backward sweep method.

Ruben Tomlin
Imperial College London

Date submitted: 31 Jul 2017

Electronic form version 1.4