Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Control of three-dimensional waves on thin liquid films 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. 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. We also may consider the influence of transverse modes on overlying film flows, these modes are damped out if uncontrolled. We also consider the more physical concept of point actuated controls which are modelled using Dirac delta functions. We first study the case of proportional control, where the actuation at a point depends on the local interface height alone. Here, we study the influence of control strength and number/location of actuators on the possible stabilization of the zero solution. We also consider the full feedback problem, which assumes that we can observe the full interface and allow communication between actuators. Using these controls we can obtain exponential stability where proportional controls fail, and stabilize non-trivial solutions.

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Date submitted: 01 Aug 2017 Electronic form version 1.4