Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Experimental and numerical study of film flows down fibers at moderate Reynolds numbers FRÉDÉRIQUE GIORGIUTTI-DAUPHINÉ, CAMILLE DUPRAT, CHRISTIAN RUYER-QUIL, JEAN-PIERRE HULIN, lab. FAST, UMR 7608, Campus Universitaire, 91405 Orsay, France, PHILIP M.J. TREVELYAN, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London, SW7 2AZ United Kingdom — We consider the stability and nonlinear dynamics of a falling liquid film down a fiber. At moderate flow rate, the primary instability involves two different mechanisms that reinforce each other: the Rayleigh–Plateau instability, promoted by the curvature of the fiber, and the hydrodynamic instability of a falling liquid film due to inertia. An experimental set-up have been built, that enables to impose a periodic forcing at inlet. Moreover, a reduced system of evolution equations for the flow rate q and the the film thickness h have been obtained trough averaging of the basic equations. This model includes all physical effects, especially viscous dispersion and inertia. Preliminary results show excellent agreement between numerical and experimental observations. The spatial response of the film to an inlet periodic forcing have been analysed, indicating that, for sufficiently large fiber radius, the film behaves as a selective noise amplifier. The characteristics of the travelling-wave solutions to our model compare well to the experimental data.

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Date submitted: 15 Sep 2006 Electronic form version 1.4