

The 2016 DCAMM Annual Seminar Speaker

Matthias Heil

Professor
University of Manchester
United Kingdom

gives the following lecture at the

Technical University of Denmark

Auditorium 13, Building 308, Kgs. Lyngby

"Wrinkly fingers" – fluid-structure interaction in elastic-walled Hele-Shaw cells

Tuesday, November 1, at 14:00

There will be an open discussion after the lecture
at 15:00
(Refreshments are served)

This lecture aims at popularizing mechanical science to a broad audience of interested students and staff as well as engineers working in industry

The Danish Centre for Applied Mathematics and Mechanics, DCAMM, is a framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark, Aalborg University, Aarhus University and University of Southern Denmark. The "DCAMM Annual Seminar Speaker" is an initiative created to disseminate mechanics to a broader audience. For further information on DCAMM, see www.dcammm.dk



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Abstract

When air is injected into the narrow, liquid-filled gap between parallel rigid plates, the axisymmetrically expanding air-liquid interface tends to be unstable to non-axisymmetric perturbations. During their subsequent growth the perturbations undergo a cascade of tip-splitting instabilities which result in the development of beautiful dendritic fingering patterns.

Recent work in Manchester has shown that this widely studied classical fluid-mechanical instability can be weakened or even suppressed by the introduction of wall elasticity via the replacement of one of the bounding plates by an elastic membrane.

In this talk I will first explain how fluid-structure interaction weakens/suppresses the (fluid-based) fingering instability, and then demonstrate that the presence of wall elasticity can induce a second (solid-based) wrinkling instability. In certain parameter regimes, both instabilities can arise concurrently. This leads to complex interactions between the fluid and solid mechanics and results in the formation of "wrinkly fingers".

