THE CRM APPLIED MATHEMATICAL PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA


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# Swelling-induced instabilities in growing polymer network


**Abstract**:

Photopolymerisation is a versatile light-driven solidification process that enables monomer-rich liquid to be converted into an elastic polymer network. Due to the ability to finely control the conversion process, photopolymerisation plays a fundamental role in modern fabrication techniques such as stereolithography and 3D printing. Under certain experimental conditions, the solidification front that separates monomer from polymer remains planar and the monomer-to-polymer conversion profile propagates as a travelling wave in a direction that follows the illumination. However, recent experiments have shown that this planar front can destabilise. We believe this is due to monomer diffusing from the liquid into the growing polymer network, which would generate compressive stresses as the network swells to accommodate the extra volume. We have found that coupling the growth and instability processes can drive the spontaneous self-assembly of three-dimensional structures.

This talk will focus on how various aspects of these experiments can be mathematically modelled. In particular, a mathematical model of photopolymersation that captures the growth, swelling, and mechanical response of the polymer network will be presented. A combination of asymptotic analysis and finite-element simulations is used to explore the coupling between growth and instability, as well as the resulting three-dimensional morphologies of the solid.


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| **Date:** | **February 2, 2017** |
| **Place:** | **Room A1** |
| **Time:** | **12:00** |