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A spatio-temporal model of wrinkling in photopolymerised networks MATTHEW HENNESSY, ALESSANDRA VITALE, PAUL STAVRINOU, OMAR MATAR, JOAO CABRAL, Imperial College London — Photopolymerisation is a common solidification process whereby crosslinked polymer networks are created by illuminating a monomer-rich bath with collimated light. In addition, photopolymerisation is extensively employed industrially and shows exceptional promise for advanced three-dimensional patterning of functional surfaces. Under conditions of strong optical attenuation and limited mass and thermal diffusion, polymerisation occurs in a localised region which propagates from the illuminated surface into the bulk as a travelling wave with a planar wavefront. Under specific conditions that we set out to map, this planar wavefront may become unstable and the surface of the resulting gel can acquire a wrinkled morphology. We believe this instability is mechanical in nature and arises from compressive stresses that are generated during frontal photopolymerization. In this talk, we will present a novel mathematical model that captures both the photopolymerisation with wrinkling processes. We show that by coupling photopolymerisation with wrinkling in a controlled manner, a number of interesting and industrially relevant patterns can be achieved.

Matthew Hennessy
Imperial College London

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