Physical Mathematics Seminar

Building with fluids – a lazy approach to manufacturing

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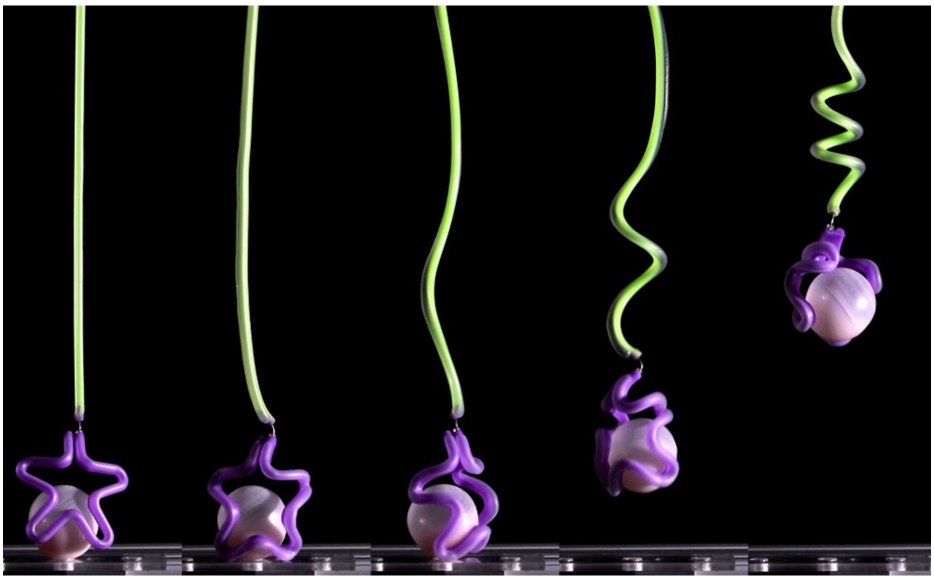
ABSTRACT:

In nature, organized arrays of elements arise spontaneously from the interactions between their component parts, e.g. reaction-diffusion problems, clustering colloidal particles and granular media, wrinkling surfaces, propagating cracks and flowing liquids. These patterns are made without the direct intervention of a centralized "patterner" — a feat that contrasts with the way we humans typically envision building complex structures through careful planning and construction, with each individual element laid in place. This traditional approach to manufacturing, relying on manual and mechanized intervention is nearing its limits in terms of efficiency and has exhausted the potential for optimization. Here I will discuss new strategies aiming to harness mechanical instabilities in flowing liquids, e.g. coiling, droplet formation, digitation, drainage, capillary suction, and use the regular shapes and universally self-organized patterns they naturally produce as templates for materials design. These flows are "frozen" as the liquids we use solidify into solids, e.g., through curing, cooling or evaporation. The shapes and patterns they form are universal and transcend the traditional divisions between scientific fields or even between living and inert matter. I will show that these similarities result from the mathematical analogies in the rules that govern pattern formation. In turn, I will demonstrate how to compose with these rules to augment our manufacturing capabilities, e.g., in soft robotics.



TUESDAY, MAY 10, 2022
2:30 PM – 3:30 PM
Building 2, Room 449

https://math.mit.edu/sites/pms/

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