PHYSICAL MATHEMATICS SEMINAR

UNCOVERING THE RULES OF CRUMPLING WITH A DATA-DRIVEN APPROACH

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ABSTRACT:

When a sheet of paper is crumpled, it spontaneously develops a network of creases. Despite the apparent disorder of this process, statistical properties of crumpled sheets exhibit striking reproducibility. Recent experiments have shown that when a sheet is repeatedly crumpled, the total crease length grows logarithmically [1]. This talk will offer insight into this surprising result by developing a correspondence between crumpling and fragmentation processes. We show how crumpling can be viewed as fragmenting the sheet into flat facets that are outlined by the creases, and we use this model to reproduce the characteristic logarithmic scaling of total crease length, thereby supplying a missing physical basis for the observed phenomenon [2].

This study was made possible by large-scale data analysis of crease networks from crumpling experiments. We will describe recent work to use the same data with machine learning methods to probe the physical rules governing crumpling. We will look at how augmenting experimental data with synthetically generated data can improve predictive power and provide physical insight [3].

[1] O. Gottesman *et al.*, Commun. Phys. **1**, 70 (2018).
[2] J. Andrejevic *et al.*, Nat. Commun. **12**, 1470 (2021).
[3] J. Hoffmann *et al.*, Sci. Advances **5**, eaau6792 (2019).

TUESDAY, APRIL 13, 2021
2:30 PM – 3:30 PM

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

https://mit.zoom.us/j/95597721876
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