Physical Mathematics Seminar

Size effects in crack kinking

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ABSTRACT:

While cracks in isotropic homogeneous materials propagate straight, perpendicularly to the tensile axis cracks, in natural and synthetic composites, they deflect from a straight path, often increasing the toughness of the material. In this talk, I will combine results from linear elastic fracture mechanics, phase-field simulations, and experiments to show what controls the kinking of the crack on a macroscale larger than the composite microstructure. In particular, I will extend the classical results of Cotterell and Rice (1980) on the effect of non-singular T-stress acting parallel to the crack, on the crack path, to account for anisotropic fracture energy. I will show that alongside the anisotropy of the fracture energy, a microstructure-dependent process zone size plays a crucial role in the kinking of the crack. I will cover three universality classes of fracture energy anisotropy and show how, in each class, the process zone size modulates the additional stabilizing or destabilizing effect of the non-singular T-stress.

TUESDAY, MARCH 17, 2020
2:30 PM – 3:30 PM
Building 2, Room 139

Reception following in Building 2, Room 290
(Math Dept. Common Room)

http://math.mit.edu/seminars/pms/