

# Exact solutions of dynamic fracture

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The theory of fracture normally describes cracks as propagating discontinuities in a continuous medium where stresses vanish on free crack faces. We describe cracks instead at the particle level and obtain the most general analytical results yet obtained. Using dynamical crack solutions for widely varying dissipation and general isotropic elastic moduli, we construct a catalog of 100,000 crack solutions and from it a general picture of when cracks are stable. For our exactly solvable model of dynamic fracture, the Rayleigh wave speed does mainly set an upper limit on crack velocity, as expected. However supersonic tensile cracks are possible and their stability is enhanced when system size is small or they travel along weak interfaces.

