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Translation by anisotropic peeling or fracturing in elastic media
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— The influence of rock anisotropy on the direction of hydraulic fracturing is an important open question. Two canonical systems have been proposed to investigate the fundamental aspects of such fluid-structure interaction problems: (i) Fluid injection and fracturing into an infinite elastic matrix (e.g., solid gelatin) and (ii) Fluid invasion and peeling beneath a deforming elastic sheet (e.g., bending plate). We investigate the second system and impose a non-uniform prewetting film thickness beneath the elastic sheet. We notice that while the bulk of the elastic sheet retains the static blister shape, a non-uniform prewetting film thickness can cause a horizontal translation of the blister. In particular, for a step jump in prewetting film thickness, asymptotic analysis indicates that, under constant fluid injection, the horizontal translation follows a $t^{7/17}$ time dependence in cartesian coordinates, and the prefactor of power-law translation depends on the ratio of the distinct prewetting film thicknesses on either side. We also provide numerical and experimental evidence demonstrating anisotropic blister evolution. This can be thought of as a model system for fluid-driven fracturing where the non-uniform prewetting film thickness mimics heterogeneity in material toughness.

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