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Poking pre-tensed elastic membranes: Regularization via a singularity DOMINIC VELLA, University of Oxford, BENNY DAVIDOVITCH, UMass Amherst — Indentation of thin elastic membranes is increasingly being used as a method of determining not only the elastic properties, but also the surface energy of such solids. Inspired by the indentation metrology of graphene and other very thin solids, which typically use an atomic force microscope or other small scale indenter, we study the idealized problem of the indentation of a pre-tensed elastic membrane. As might be expected, the limit of a point indenter has a singular stress field close to the point of indentation. However, this singularity is important for properly understanding the case of an indenter of small, but finite, size, and also regularizes an apparent softening of membranes as the indenter size shrinks. We then show that many previous experiments lie in an intermediate regime where the use of approximate analytical results leads to large relative errors and suggest how these problems might be avoided experimentally.

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