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**Arbitrarily Shaped Graphene Nanomechanical Resonators** DAVID MILLER, BENJAMIN ALEMAN, University of Oregon — The geometric shape of a mechanical resonator plays an important role in determining its frequency, mass, and dissipation. Thus, tailoring the shape can improve the system's sensitivity to physical quantities, such as mass and force, while also enabling the study of complex dynamics. Graphene nanomechanical resonators, despite many promising attributes, have rarely been shaped beyond simple drumheads or doubly clamped beams. This limitation has been driven by challenges in traditional lithographic fabrication approaches. Here we show that focused ion beam milling is a rapid, high-yield fabrication technique that can be used to shape pre-suspended graphene into devices with arbitrary geometry, with feature sizes ranging from several nanometers to several microns. We describe the specific cutting methods needed to realize such devices. We observe that by modifying the geometry, we can tune resonance frequencies, significantly increase the quality factor, and introduce mechanical nonlinearities at low driving powers.

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