Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Cracking Sheets into Shapes: Linear actuators from non-linear crack behavior MARCELO A. DIAS, James Madison University, DANIEL RAYNEAU-KIRKHOPE, Aalto University, MICHAEL MCCARRON, DOUGLAS P. HOLMES, Boston University — In recent years, the mechanics of highly deformable and soft complex structures have gained significant attention across interdisciplinary fields. A theoretical mechanics treatment of such systems, so as to include geometric non-linearities from large deflections, remains a challenging and timely task in order to unleash their full potentials for functionalization. With a focus on the design of thin plates patterned with cracks (cuts), we shall discuss how these structures reveal new effectively non-linear and anisotropic responses to external forces and strains, thus opening the path to practical problems in linear actuation. Sheets patterned with cuts, also known as Kirigami, that are thin enough to relieve localized stress through out-of-plane deformation, still lack fundamental models to describe their out-of-plane behavior. We propose to give a robust geometric and mechanical account of these structures that goes beyond past related attempts where inextensibility constraints were enforced. We will also demonstrate fundamentally new responses in our experiments, and explain how large scale geometric features are dominated by localization at the crack tip.

Marcelo A. Dias
James Madison University

Date submitted: 10 Nov 2016 Electronic form version 1.4