Abstract Submitted
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On the mechanics of elastic lines in thin shells[1] EDUARD BENET, FRANCK VERNEREY, Univ of Colorado - Boulder — The deformation of soft shells in nature and engineering is often conditioned by the presence of lines whose mechanical properties are different from the shell. For instance, the deformation of tree leaves is conditioned by the presence of harder stems, and cell mitosis is driven by a stiffening line along its membrane. From an experimental standpoint, many groups have taken advantage of this feature to develop self-actuated shells with prescribed deformations. Examples include the polymerization of gels along certain lines, or the inclusion of stiffer lines via 3D printing. However, there is not yet a general continuum theory that accounts for this type of discontinuity within the membrane. Hence, we extend the general shell theory to account for the inclusion of a line that potentially induces jumps in stresses, couple stresses and moments, across its thickness. This is achieved via coupling the rod and the membrane deformations, and ensuring continuity of displacements. The model is then applied to three important problems: a constriction disc inside a shell of revolution, the induced twisting of a shell via the torsion of an embedded line, and the effect of an helicoidal line on the uni-axial deformation of a cylindrical shell.

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