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Mechanics of a Knitted Fabric[1] SAMUEL POINCLOUX, FREDERIC LECHENAULT, MOKHTAR ADDA-BEDIA, Laboratoire de Physique Statistique, Ecole Normale Suprieure, 24 rue Lhomond, 75005 Paris, France — A simple knitted fabric can be seen as a topologically constrained slender rod following a periodic path. The non-linear properties of the fabric, such as large reversible deformation and characteristic shape under stress, arise from topological features known as stitches and are distinct from the constitutive yarn properties. Through experiments we studied a model stockinette fabric made of a single elastic thread, where the mechanical properties and local stitch displacements were measured. Then, we derived a model based on the yarn bending energy at the stitch level resulting in an evaluation of the displacement fields of the repetitive units which describe the fabric shape. The comparison between the predicted and the measured shape gives very good agreement and the right order of magnitude for the mechanical response is captured. This work aims at providing a fundamental framework for the understanding of knitted systems, paving the way to thread based smart materials.

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