M2 Internship or/and PhD (2023-2024)

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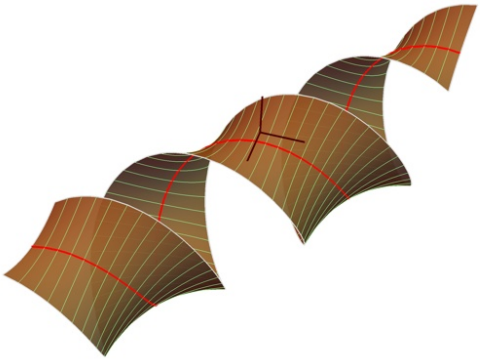
Structural Design with Elastic Ribbons

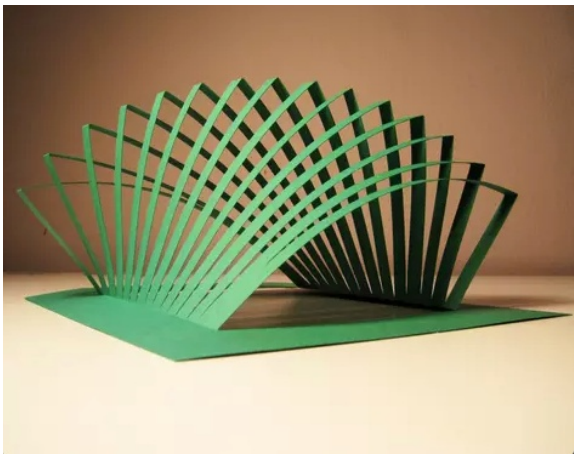
From cable plies and fashion accessories to hair ringlets, flexible band-shaped structures, namely ribbons, are widely present in our daily environment. While the mechanical study of ribbons was initiated in the 1930s, there is nowadays a renewed interest in the understanding and modeling of these fascinating structures.

Our team studies theoretically, numerically, and experimentally the statics and dynamics of elastic structures and in the present project we plan to focus on the numerical modeling of these ribbons.

The main goal of this project is to upgrade substantially an existing in-house ribbon code (C/C++) currently devoted to the statics of flat rectangular ribbons. Different physical models of elastic ribbons will be considered (naturally flat or curved; without or with geodesic curvature; inextensible, extensible, or rod-like behavior) as well as a possible extension to dynamics. Physical validation will be used to verify the numerical approach. Applications include the inverse design of strip-like shapes as well as the numerical exploration of kirigamis.



Static ribbon configuration with twist



Designing shapes with ribbons

Depending on the candidate, the present study could involve a mix of **theoretical** (buckling and bifurcation analysis), **modeling** (variational formulation, dimensional reduction), and **numerical** (minimization, ODEs, PDEs) approaches. Numerical work will use Python, Mathematica, or C/C++.