Energy scaling for von Kármán elastic plates with positional constraints

12-16th of January 2026

Abstract: The studies behind the behavior of elastic plates under different kinds of stress (and the resulting deformations) have often focused on models that study the mid-plane section of the plate, reducing it to a two dimensional problem. One of the most studied models is the von Kármán model, with energy functional $U_h = \int \left|\frac{1}{2}\nabla v \otimes \nabla v + \operatorname{sym} \nabla w\right|^2 + h^2 \left|\nabla^2 v\right|^2 dx$ dependant on the bending stiffness h of the plate. This talk presents the problem of finding bounds for the scaling of the elastic energy as $h \to 0$ as we limit the bent plate in the 3D space through positional constraints by placing the plate between two obstacles. The question is non trivial because of the interplay of the two expressions that compose the energy: with generic positional constraints we cannot ensure for a 0-energy minimizer and, in fact, looking at parallel results for the Föppl-von Kármán model we can conjecture a scaling of order $h^{\frac{5}{3}}$. We will see how this energy scaling can be attained on the upper bound via an approximation by piecewise affine maps, which is born from the purely geometrical idea of *origami maps*.