**Dimension reduction via Gamma-convergence of non-convex energies, and the quantitative immersability of Riemannian metrics.**

**ABSTRACT:** In this talk, we present results that relate the following three contexts:

(i) Given a Riemannian metric $G$ we study the problem of finding the infimum of the averaged pointwise deficit of an immersion from being an orientation-preserving (equi-dimensional) isometric immersion of $G$. We are also interested in discovering the structure and regularity of the optimal immersion. Questions of this type can be seen as a quantitative variation of the very classical topics in Differential Geometry: existence, rigidity and flexibility of isometric immersions.

(ii) Given a family of non-convex energies $E^h$, parametrized by a three-dimensional plate’s thickness $h$, we are interested in finding the scaling laws of the infima of $E^h$, in terms of the powers of $h$, as $h$ goes to 0. Subsequently, we want to derive the Gamma-limits (variational limits) of $E^h$ and reveal the asymptotic structure of the minimizing sequences. This topic is classical in the Calculus of Variations and may also be seen as a variation of the study of nonlinear elasticity.

Combining (i) and (ii), we first show how the deficit mentioned in (i) can be measured by the energies $E^h$ in (ii), and perform the full scaling analysis of $E^h$, in the context of dimension reduction. Then, we derive the Gamma-limits of $h^{-2n}E^h$ for all powers $n$. We show the energy quantization, in the sense that the even powers $2n$ of $h$ are the only possible ones (all of them are also attained). For each $n$, we identify conditions for the validity of the corresponding scaling, in terms of the vanishing of Riemann curvatures of $G$ up to appropriate orders, and in terms of the singular behavior of the minimizing immersions.

We will further explain how the above problems are linked to:

(iii) The description of elastic materials exhibiting residual stress at free equilibria. Examples of such structures and their actuations include: plastically strained sheets; specifically engineered swelling or shrinking gels; growing tissues, and atomically thin graphene layers. Our results and methods display the interaction of nonlinear pdes, geometry and mechanics of materials in the prediction of patterns and shape formation.

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