Asymptotic rigidity of layered structures and its applications in homogenization theory

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Rigidity results in elasticity are powerful statements that allow to derive global properties of a deformation from local ones. The classical Liouville theorem states that every local isometry of a domain corresponds to a rigid body motion. If connectedness of the set fails, clearly, global rigidity can no longer be true.

In this talk, I will present a new type of asymptotic rigidity theorem, which shows that if an elastic body contains sufficiently stiff connected components arranged into fine parallel layers, then strict global constraints of anisotropic nature occur in the limit of vanishing layer thickness. The optimality of the scaling relation between layer thickness and stiffness can be identified with the help of explicit bending constructions.

Besides its theoretical interest, the result constitutes a useful tool for the homogenization of variational problems modeling high-contrast bilayered composite materials. We willl discuss two models in nonlinear elasticity and finite crystal plasticity and show how to determine their homogenized Gamma-limits in terms of explicit formulas.

This is joint work with Fabian Christowiak (University of Regensburg).