

## Guy Bouchitté

### *Homogenization of second order energies on periodic thin structures*

This is a joined work with I. Fragalà (Milan) and M.Rajesh (CMAF, Lisbonne) [3].

We study the homogenization of integral functionals depending on the Hessian matrix over periodic low-dimensional structures in  $\mathbb{R}^n$ . To that aim, we follow the same approach as in [1], where the case of first order energies was analyzed. Precisely, we identify the thin periodic structure under consideration with a positive measure  $\mu$ , and we associate with  $\mu$  an integral functional initially defined just for smooth functions. We prove that, under a suitable connectedness assumption on  $\mu$ , the homogenized energy is an integral functional of the same kind, now with respect to the Lebesgue measure, whose effective density is obtained by solving an infimum problem on the periodicity cell. Such a problem presents basic differences from the first order case, as it involves both the microscopic displacement and the microscopic bending (Cosserat field). This feature is a consequence of the relaxation result for second order energies on thin structures proved in [2]. In the case when the initial energy density is quadratic and isotropic, we apply the main homogenization theorem to compute explicitly the effective density for several examples of geometries in the plane. We derive also some bounds on the eigenvalues of the homogenized tensor in the same spirit as in [4,5].

- [1] G. Bouchitté, I. Fragalà, Homogenization of thin structures by two-scale method with respect to measures, *Siam Journal of Mathematical Analysis* **32** (2001), 6, 1198-1226.
- [2] G. Bouchitté, I. Fragalà, Second order energies on thin structures: variational theory and non-local effects, *J. Funct. Anal.* **204** (2003), 1, 228–267.
- [3] G. Bouchitté, I. Fragalà, M. Rajesh, Homogenization of second order energies on periodic thin structures, *Calc. Var. Partial Differential Equations* **20** (2004), 2, 175–211.
- [4] G. Bouchitté, I. Fragalà, Homogenization of elastic thin structures: a measure-fat-tening approach, *J. Convex Analysis* **9** (2002), 2, 339–362.
- [5] G. Bouchitté, G. Buttazzo, I. Fragalà, Bounds for the effective coefficients of homogenized low dimensional structures, *J.Mat.Pures Appliquées* **81** (2002), 453–469.