
A regularity theory for elliptic systems with random coefficients

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Abstract

We study the regularity of elliptic systems with stationary and ergodic, random coefficients and consider the associated stochastic homogenization problem from a quantitative perspective. Following the philosophy of Avellaneda and Lin, developed in the context of deterministic, periodic homogenization, we lift the regularity theory of the homogenized limit to the heterogeneous situation and obtain $C^{1,\alpha}$ estimates on large scales, where "large" is quantified in terms of a minimal radius that measures the (sublinear) growth of the generalized corrector. In a purely deterministic part, we show that on length scales larger than the minimal radius, the equation features the same regularity properties as the constant-coefficient equation. In a second part, based on a quantification of ergodicity via a coarsened logarithmic Sobolev inequality (which allows for arbitrarily slow-decaying correlations), we derive stretched exponential moment bounds for the minimal radius. Finally, we apply the theory to stochastic homogenization and obtain various quantitative results, e.g. on the spatial growth of the corrector and the error of the two-scale expansion. The talk is based on a joint work with Antoine Gloria and Felix Otto.

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