Lecture NMMA469 (2+0) Winter term 2018/2019

An introduction to mathematical homogenization

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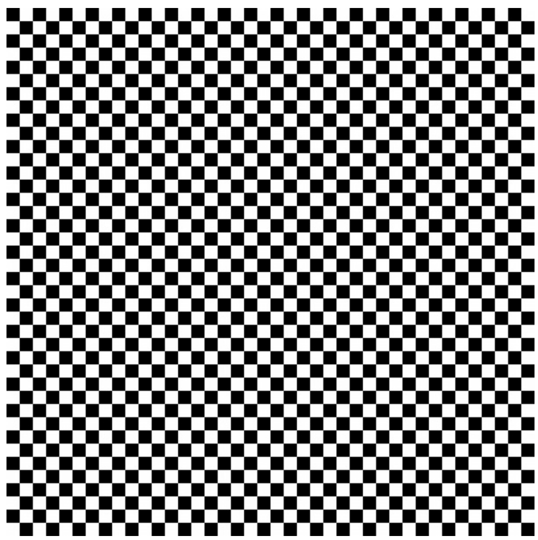
Monday, 17:20–18:50, seminar room K12, 3rd floor, Karlín

In homogenization theory we study the link between microscopically heterogeneous quantities and their "effective" macroscopically homogeneous counterparts, as well as the laws and material properties describing them in specific models. A simple example is the way we perceive a checkerboard pattern:



Seen from afar, or if the pattern is fine enough, the "microscopic" black and white pattern is no longer visible, instead we see a homogeneously gray area. In the lecture, we will mathematically study this homogenization limit, as the characteristic length scale of the microstructure (the pattern) converges to zero. The main focus will be on mathematical models where the relevant microscopic states are solutions of convex variational problems or linear elliptic PDE's. Physical examples for such homogenization problems include the "effective" electrical or heat conductivity of fine mixtures of to two different materials. Mathematically, we will mainly introduce and apply variational methods, in particular weak two-scale convergence.

Necessary prior knowledge: basic theory of linear elliptic PDE's in weak formulation, convex minimization problems, the Sobolev space $W^{1,p}$, weak convergence

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