Effective Approximation based on Boundary Measurements

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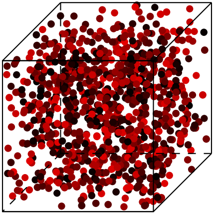
An Inverse Multiscale Problem

- Consider the heterogeneous problem with small scale of variation ε.

$$\begin{cases} -\mathrm{div}\,(A_\varepsilon \nabla u) = 0 & \text{in } \Omega, \\ (A_\varepsilon \nabla u) \cdot n = g & \text{on } \partial\Omega \end{cases}$$



- A_ε is assumed to be unknown.
- Only boundary (possibly aggregated) information is available.

Objective

Construct a constant diffusion coefficient $\overline{A}^{opt}$, such that the solutions $u(\overline{A}^{opt}, g)$ to the associated coarse diffusion problem are satisfactory approximations of the solutions $u(A_\varepsilon, g)$ to the oscillating problem.

Strategy: Homogenization, Optimization