

Homework 3

Our goal is to compare the fine-scale solution with the coarse-scale solution for nonlinear parabolic equation. Consider

$$\frac{\partial}{\partial t}p(x, t) = \operatorname{div}(k(x, p(x, t))\nabla p(x, t)),$$

in a unit square with boundary conditions $p = x$ and $0 < t < 2$. Take

$$k(x, p) = \exp(p \sin(20(x_2 - x_1))).$$

- (1) Solve the fine-scale equation (present the code).
- (2) Compute the upscaled coefficients $k^*(x, \eta)$ with η varying between 0 and 1 at 10 equally spaced points (present the table).
- (3) Solve the coarse-scale equation with k^* (present the code).
- (4) Compare the average fine-scale solution as a function of time with the average coarse-scale solution (plot the results).