Abstract:
Looking at a coupled system of PDEs posed in a non-periodically perforated domain, I derive the corresponding homogenization limit equations and effective coefficients — a coupled system of PDEs posed in an homogeneous domain, with computable coefficients depending on both the coefficients of the initial PDEs system and choice of the heterogeneity (perforations) of the medium. To fix ideas, I consider a coupling between the Stokes system and reation-diffusion equations (modeling the interplay between flow and active chemical species) for which I perform a formal two-scale asymptotic expansion. After proving the well-posedness of the system in x-dependent Bochner spaces, I state corrector estimates (for concentrations and fluxes) justifying herewith rigorously the asymptotics. I close the discussion with a few numerical illustrations.

More details on this and related issues can be found in:

1. A. Muntean, T. van Noorden: Corrector estimates for the homogenization of a locally-periodic medium with areas of low and high diffusivity. Eur. J. Appl. Math. 24 (2013), (5), 657-677.

2. T. van Noorden, A. Muntean: Homogenization of a locally-periodic medium with areas of low and high diffusivity. Eur. J. Appl. Math. 22 (2011), (5), 493-516.

3. A. Muntean, M. Neuss-Radu: A multiscale Galerkin approach for a class of nonlinear coupled reaction-diffusion systems in complex media. JMAA 371 (2010), (2), 705-718.

4. T. Fatima, N. Arab, E. Zemskov, A. Muntean: Homogenization of a reaction-diffusion system modeling sulfate corrosion in locally-periodic perforated domains. J. Engng. Math. 69(2011), (2), 261-276.

5. S. Meier, M. Peter, A. Muntean, M. Böhm, J. Kropp: A two-scale approach to concrete carbonation in Proc. Int. RILEM Workshop on Integral Service Life Modeling of Concrete Structures, Guimares, Portugal, 2007, 3–10.