FAU Erlangen-Nürnberg
Department Mathematik
PD Dr. Maria Neuss-Radu

Masterseminar

Introduction to homogenization theory and applications to fluid flow coupled to transport processes in porous media

Supervisors: Markus Gahn, Maria Neuss-Radu

Language: English

Prerequisites: Basic lectures in Partial Differential Equations. Knowledge in Functional Analysis is helpful.

Target group: Students from M.Sc. Mathematics as well as students from M.Sc. Computational and Applied Mathematics (CAM) from the 2nd semester on.

Contents: Transport processes in porous media are often described by macroscopic ("effective") partial differential equations, which include the pore structure ("microscopic structure") of the medium by means of effective coefficients. On the one hand, such laws can be derived experimentally. On the other hand, effective laws can be derived mathematically rigorously by using the methods of multiscale analysis and homogenization, starting from partial differential equations at the pore scale. In the seminar, the method of homogenization is introduced and applied to processes such as diffusion, transport and reaction in porous media.

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Literature:

[1] D. Cioranescu, P. Donato: An introduction to Homogenization, Oxford University Press, NY 1999.
[2] G. Allaire: Homogenization and two-scale convergence, SIAM J. Math. Anal. 23:1482-1518, 1992.
[3] G. A. Chechkin, A. L. Piatnitski, A. S. Shamaev: Homogenization: Methods and Applications, American Mathematical Society, 2007.
[4] M. Gahn: Introduction to multi-scale analysis and homogenization, Lecture notes.