



Minisymposium 8 - Homogenisierung und Anwendungen

Derivation of a macroscopic receptor-based model using homogenization techniques

MARIYA PTASHNYK (IWR, UNIVERSITY OF HEIDELBERG)

The aim of this work is to derive a macroscopic model describing receptor-ligand binding from the microscopic description using the methods of asymptotic analysis. We study the problem of diffusive transport of biomolecules in the intercellular space, modeled as porous medium, and of their binding to the receptors located on the surface membranes of the cells. Cells are distributed periodically in a bounded domain. To describe this process we introduce a reaction-diffusion equation coupled with nonlinear ordinary differential equations on the boundary (on the cells surface). The existence and uniqueness of the solution of this problem is proved. We consider the limit, when the number of cells tends to infinity and at the same time their size tends to zero, while the volume fraction of the cells remains fixed. Using the two-scale convergence, we show that the sequence of solutions of the original problem converges to the solution of the so called macroscopic problem. To show the convergence of the nonlinear terms on the surfaces we use the periodic modulation (unfolding method).