Multiscale analysis and simulation of a reaction-diffusion problem with transmission conditions

Maria Neuss-Radu
University of Heidelberg, Germany

We consider a transmission problem for partial differential equations obtained in the recent paper [1] as the effective system modeling a reaction-diffusion process in two domains separated by a membrane. For the analysis of this problem an appropriate function space, which includes the coupling conditions for the concentrations on the interface, is introduced. The transmission conditions for the flux are included in the variational formulation with respect to this function space.

The solution of the transmission problem is approximated by using the Galerkin method. Numerically the problem is reduced to a system of ordinary differential equations, where the coupling of the micro- and macro-variables leads to a special structure, distinguishing the variables relevant for the transmission. Results of numerical simulations are illustrating the effect of the microscopic process in the membrane on the macroscopic reaction-diffusion process in the bulk domains.

This contribution is a joint work with Willi Jäger and Stephan Ludwig, University of Heidelberg.

References

[1] Neuss-Radu, M., Jäger, W. *Effective transmission conditions for reaction-diffusion processes in domains separated by an interface*. SIAM J. Math. Anal. **39**, 687–720 (2007)

[2] Neuss-Radu, M., Ludwig, S., Jäger, W. *Multiscale analysis and simulation of a reaction-diffusion problem with transmission conditions*. Submitted to Nonlinear Analysis-RWA