Thin layer approximation: behavior of boundary and transmission conditions

Adam Bobrowski

Reaction-diffusion equations, an important class of PDEs, describe numerous processes in physics and biology. Interestingly, there are important cases in which the domain where they are considered is characterized by two different linear dimensions, one small (for example, describing thickness), the other large. In many such cases, it is desirable to approximate 3D PDEs by 2D PDEs, by considering the limit when the smallest linear dimension converges to zero. This is called thin layer approximation.

The talk summarizes recent semigroup-theoretic results in this field in a couple of geometrical scenarios. We will be mostly concerned with the fact that Robin-type boundary and transmission conditions, that are indispensable for the approximating 3D PDEs, in the thin layer approximation may 'vanish' and reappear as legitimate parts in the limit 2D PDEs.

The work was originally inspired by a model of activation of B lymphocytes.

Adam Bobrowski, Lublin University of Technology
e-mail : a.bobrowski@pollub.pl