Reaction-diffusion systems in thick fractal junctions with applications

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In recent years, materials with complex structure are widely used in engineering devices, biology and other fields of science. It is known that many properties of materials are controlled by their geometrical structure. Therefore, the study of the influence of the material microstructure can improve its useful properties and reduce undesirable effects. Mathematical models for this study are boundary-value problems (BVP's) in domains with complex structures: perforated domains, grid-domains, domains with rapidly oscillating boundaries, thick junctions, etc.

Successful applications of thick-junction constructions in nanotechnologies and microtechnique have stimulated active learning BVP's in thick junctions with more complex structures: thick multi-level junctions, thick cascade junctions (see [1]–[4] and references therein).

In my report I am going to present new results for reaction-diffusion systems in thick fractal junctions with applications arising in medicine and biosciences.

[1] T.A. Mel'nyk, D.Yu. Sadovyj, Homogenization of boundary value problems in two-level thick junctions consisting of thin disks with rounded or sharp edges. *Journal of Mathematical Sciences*, **191** (2013), no. 2, p. 254–280.

[2] T. Durante, T.A. Mel'nyk, Homogenization of quasilinear optimal control problems involving a thick multilevel junction of type $3 : 2 : 1$. *ESAIM: Control, Optimisation and Calculus of Variations*, **18** (2012), no. 2, p. 583–610.

[3] G.A. Chechkin, T.A. Mel'nyk, Spatial-skin effect for eigenvibrations of a thick cascade junction with "heavy" concentrated masses *Math. Meth. Appl. Sci.* **37** (2014), p. 56–74.

[4] D. Blanchard, A. Gaudiello and T.A. Mel'nyk, Boundary homogenization and reduction of dimension in a Kirchhoff-Love plate, *SIAM J. Math. Anal.* **39** (2008), no. 6, p. 1764–1787.