

**Solution of direct and inverse reaction-diffusion-advection problems in the high-dimensional case via an asymptotic expansion based approach**

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In this article, we continue the study published in [1], where the one-dimensional problem of determining the source function in the reaction-diffusion-advection equation was considered, by considering two and three-dimensional formulations of the problem. The results of this work can be found in [2, 3].

Reaction-diffusion-advection problems are successfully used to model various physical phenomena, including the construction of autowave models. We use the asymptotic expansions method to solve the direct and inverse singularly perturbed reaction-diffusion-advection problem and determine the conditions for the existence of a smooth solution with a sharp transition layer inside of the considered domain. To effectively use the asymptotic method, we introduce the local coordinates in the vicinity of the inner transition layer, what help us to describe the location of the transitional layer. Afterwards we prove the existence and uniqueness of the resulting solution.

Asymptotic analysis also simplifies the solution of the inverse problem of finding the source function by obtaining a simpler model of the original problem that gives an accurate solution in the entire region, except for a narrow region where the transition layer is located. Thus, using asymptotic analysis, we can exclude the noisy data from the inner transition layer region, then smooth the remaining noisy data and, substituting it into the simplified model, obtain a solution of the inverse problem with high accuracy. The results of a numerical experiment are presented, confirming the effectiveness of the proposed approach.

The work has been supported by the National Natural Science Foundation of China (No. 12171036) and Beijing Natural Science Foundation (Key project No. Z210001).

REFERENCES

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