Asymptotic preserving moment methods for haptotaxis equations in general space dimension

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Abstract

The so-called haptotaxis equation is a special class of transport equation that arises from models of biological cell movement along tissue fibers. In particular a model for glioma migration in the human brain is studied here([1], [2]). This equation has an anisotropic advection-diffusion equation as its macroscopic limit. An up to second-order accurate asymptotic preserving method is developed for the haptotaxis equation in space dimension up to three. For this the micro-macro decomposition proposed by Lemou and Mieussens([3]) is generalized in the context of finite-volume schemes on staggered grids. The spurious modes that arise from this discretization can be eliminated by combining flux evaluations from different points in the right way. The velocity space is discretized by an arbitrary-order linear moment system.

Keywords: Multiscale model, glioma invasion, kinetic transport equation, asymptotic preserving, macroscopic scaling, moment closure, reaction-diffusion-transport equations

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