Numerical approximation of a non-local 2-dimensional model of multi-lane traffic-flow

Martin Fleurial Gabriella Puppo Paola Goatin

Abstract

We propose a new model of multi-lane traffic-flow defined on complex two-dimensional geometries, in particular for roads with turns or merging and diverging lanes. In this model, lane-changes are modeled via a parabolic term, which diffusive effects are counter-balanced by a non-local relaxation term, modeling the tendency of cars to drive in the center of the lanes. The resulting equation exhibits hyperbolic and diffusive behaviors along two orthogonal vector fields, everywhere on the road. By considering particular unstructured meshes of the domain, and using an implicit-explicit approach, we construct a numerical scheme which is positivity-preserving, conservative and $L^1 \& L^{\infty}$ -stable.