Numerical Methods for Modern Traffic Flow Models

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Abstract: I will describe two different traffic flow models. The first model is a scalar conservation law with Arrhenius look-ahead dynamics. It is a modification of the classical fluid dynamics model by Lighthill and Whitham. The modification is based on an assumption that unlike the fluid particles, drivers can see the traffic dynamics ahead of their cars and adjust the speeds of their cars correspondingly. This factor results in a global dependence of the flux on the solution, which makes it challenging to develop numerical methods for the studied scalar conservation law.

The second model is a modification of the Aw-Rascle system, designed to describe the formation and dynamics of traffic jams. The model consists of a constrained pressureless gas dynamics system, which is extremely stiff. The stiffness makes it difficult to develop robust and accurate explicit numerical schemes for this model.

I will present several numerical methods for the above two models and demonstrate their superb performance on a number of numerical examples.

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