Kinetic and Related Models
Website: http://aimSciences.org

Volume **1**, Number **2**, June **2008**
pp. **279–293**

MODELLING AND SIMULATION OF VEHICULAR TRAFFIC JAM FORMATION

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(Communicated by Tong Yang)

Abstract. This paper deals with the modelling and simulation of traffic flow phenomena at the macroscopic level, based on a suitable development of the Aw-Rascle model, [2], and its modification, [4], [5]. An acceleration term and a minimal velocity–dependent safety distance are introduced in the evolution equations. Then, an eulerian computational scheme is introduced to simulate the formation and evolution of jams. The results are compared with those obtained in [4], where a lagrangian computational method was used instead.

1. **Introduction.** Mathematical models of vehicular traffic are usually grouped into three main categories, according to the "scale of observation" at which the phenomena are analyzed, see for instance the review papers [11], [9]. Therefore, in scientific literature one can find: **microscopic models**, or "Follow-the-Leader" models, **kinetic models**, among which cellular automata models, and **macroscopic** or **fluid models**.

This paper deals with the modeling and simulation of traffic flow phenomena at the macroscopic level. Analogously to the description of system of fluid mechanics, traffic macroscopic models are based on the derivation, under suitable conservation conditions, of an evolution equation for the mass density, linear momentum and possibly energy, which are regarded as macroscopic observable quantities of the flow of vehicles. Therefore, the "conservation of the mass density" is equivalent to the "conservation of the number of vehicles", while the "conservation of linear momentum" and "conservation of energy" which no more hold true due to braking/acceleration phenomena have to be replaced by more adequate models. First-order macroscopic models consist of one conservation equation, i.e. the density of cars per unit portion of road, while second-order macroscopic models are obtained adding a second evolution equation related to the evolution of the mean velocity.

Because cars (and drivers) have physical properties that usually fluids do not have, second order models have been deeply criticized, see Daganzo, [7]. Aw and

2000 *Mathematics Subject Classification.* Primary: 76P05.

Key words and phrases. Traffic flow simulations; hyperbolic equations; Eulerian computational model; Lagrangian computational model.

Partially supported by INDAM: "Grant for Foreign Visiting."