On Kinetic Fokker-Planck Multilane Traffic Models: Equilibria, multivalued fundamental diagrams, and links to second-order conservation law

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Abstract

We describe multilane kinetic traffic models of Fokker-Planck type with lane-changing terms. The following analytical and numerical matters will be addressed:

1. Stationary solutions and single- or multi-valued fundamental diagrams.
2. Criteria for fundamental diagram to be single-valued. The origin of extra branches.
3. Linear stability analysis of the equilibria associated with the branches of the fundamental diagram.
4. A derivation of the Aw-Rascle second-order system of conservation laws from a kinetic Fokker-Planck model.
5. Implications for stop-and-go waves and other traffic phenomena.