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A junction model for ramp metering

Maria Laura Delle Monache and Samitha Samaranayake - ORESTE

We proposed a new junction model for highway ramps in the continuous setting and a Gudonov discretization of the model for ramp metering control. We consider the Lighthill---Witham---Richards traffic flow model on a junction composed by one mainline, an on---ramp and an off---ramp, which are connected by a node. In particular, a partial differential equation describes the evolution of the vehicle flow on the mainline and an ordinary differential equation describes the evolution of the queue length at the on--- ramp which is modeled by a buffer to ensure that boundary conditions are satisfied in strong sense. The definition of the solution of the Riemann problem at the junction is based on an optimization problem and the use of a right---of---way parameter. We prove the existence and uniqueness of the solution of the corresponding Riemann problem. This approach is extended to networks and discretized using a Godunov scheme that takes into account the effects of the on---ramp buffer. The corresponding discrete optimization problem is solved using an adjoint based descent scheme. We present the results of some simulations. This model also serves as starting point for a subsequent model for optimal rerouting, which includes multi---commodity flow and partial control.

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