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Uncertainty damping in the macroscopic forecast of vehicular traffic flow

ABSTRACT

In this seminar, we concentrate on the traffic flow description with uncertain interaction forces. We explain the typical scattering of the fundamental diagram in terms of the macroscopic variability of aggregate quantities. Moreover, we implement ADAS-type control strategies at the level of the microscopic interactions among the vehicles, by which we prove that it is possible to dampen the propagation of such an uncertainty across the scales. Our analytical and numerical results suggest that the aggregate traffic flow may be made more ordered, hence predictable, by implementing such control protocols in driver-assist vehicles. Remarkably, they also provide a precise relationship between a measure of the macroscopic damping of the uncertainty and the penetration rate of the driver-assist technology in the traffic stream.

BIOGRAPHY

Mattia Zanella is currently Assistant Professor at the Department of Mathematical Sciences "G. L. Lagrange", Politecnico di Torino. His research interests are focused on uncertainty quantification for kinetic equations, optimal control methods and kinetic models for collective phenomena. He obtained his PhD in 2017 with a thesis entitled "Boltzmann type and mean-field modeling of social dynamics: numerics, control, uncertainty quantification" under the direction of Prof. Lorenzo Pareschi. During his PhD he has been visiting student at the University of Wisconsin-Madison, Imperial College and RWTH Aachen University. He was the recipient of the "Nicolò Copernico Award 2018" for young PhD fellows distinguished for an innovative thesis in science and technologies. In 2019 he received a fellowship from the Hausdorff Research Institute for Mathematics of the University of Bonn.

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