POLITECNICO DI TORINO

DISMA Dipartimento di Scienze Matematiche G. L. Lagrange

ECCELLENZA 2018 • 2022

Thursday November 14, 2019 at 15:30
Politecnico di Torino, DISMA, Aula Seminari (third floor)

Felisia Angela CHIARELLO

PhD student at Inria - Sophia Antipolis

Non-local conservation laws for traffic flow modeling

Prof. Andrea Tosin introduces the seminar.

Abstract

In this talk, we provide mathematical traffic flow models with non-local fluxes and adapted numerical schemes to compute approximate solutions to such kind of equations. More precisely, we consider flux functions depending on an integral evaluation of the conserved variables through a convolution product.

First of all, we prove the well-posedness of entropy weak solutions for a class of scalar conservation laws with non-local flux arising in traffic modeling. This model is intended to describe the reaction of drivers that adapt their velocity with respect to what happens in front of them. We approximate the problem by a Lax Friedrichs scheme and we provide some estimates for the sequence of approximate solutions. Stability with respect to the initial data is obtained.

We study also the limit model as the kernel support tends to infinity. After that, we prove the stability of entropy weak solutions of a class of scalar conservation laws with non-local flux under higher regularity assumptions. We also prove the existence for small times of weak solutions for non-local systems in one space dimension, given by a non-local multi-class model intended to describe the behaviour of different groups of drivers or vehicles. We present some numerical simulations illustrating the behavior of different classes of vehicles and we analyze two cost functionals measuring the dependence of congestion on traffic composition. Furthermore, we propose alternative simple schemes to numerically integrate non-local multiclass systems in one space dimension. We obtain these schemes by splitting the non-local conservation laws into two different equations, namely, the Lagrangian and the remap steps. We show some numerical simulations illustrating the efficiency of the L-AR schemes in comparison with classical first and second order numerical schemes.

Finally, we introduce a traffic model for a class of non-local conservation laws at road junctions. Instead of a single velocity function for the whole road, we consider two different road segments, which may differ for their speed law and number of lanes.

Biography

Felisia Angela Chiarello obtained the Laurea Magistrale (Master degree) in Mathematics with full marks cum laude at University of Bari (Italy), in 2017. Her Master thesis was on 'Conservation laws and vanishing viscosity on network', under the supervision of Prof. Giuseppe M. Coclite and MCU Carlotta Donadello. From October 2016 until February 2017, she was Erasmus+ student at University of Besançon (France). From May 2017, she is a Ph.D. student at Inria of Sophia Antipolis (France) under the supervision of Dr. Paola Goatin. The Ph.D. thesis is on 'Non-local conservation laws for traffic flow modeling'. She also spent a research period of three months, from March 2019 until May 2019, at University of Mannheim (Germany), to work with Prof. Simone Goettlich.

Save the date for the next event: November 21, 2019

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