

# NON-LOCAL CONSERVATION LAWS: THEORY, NUMERICS AND APPLICATIONS

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**ABSTRACT.** In this talk, I will revise recent results on well-posedness and numerical approximation of conservation laws with integral dependencies in the flux function, typically in the form of convolution products. This type of equations arises in a variety of physical, engineering and biological applications, where integral terms account for non-local interaction phenomena. In this setting, the main challenges are represented by the analytical characterization of solutions, the treatment of boundary conditions and the reduction of numerical simulation costs. These are functional to the solution of optimal control problems arising in applications. In particular, I will focus on applications to vehicular and pedestrian traffic modeling.

**Keywords:** non-local conservation laws; high-order finite volume schemes; macroscopic flow models; PDE constrained optimization

**Mathematics Subject Classifications (2010):** 35L65, 65M08, 90B20.

## REFERENCES

- [1] A. Aggarwal, R.M. Colombo and P. Goatin. Nonlocal systems of conservation laws in several space dimensions. *SIAM J. Numer. Anal.*, 53(2) (2015), 963-983.
- [2] S. Blandin and P. Goatin. Well-posedness of a conservation law with non-local flux arising in traffic flow modeling. *Numer. Math.*, 132(2) (2016), 217-241.
- [3] R. Bürger, P. Goatin, D. Inzunza and L.M. Villada. A non-local pedestrian flow model accounting for anisotropic interactions and domain boundaries. *Math. Biosci. Eng.*, 17(5) (2020), 5883-5906.
- [4] C. Chalons, P. Goatin and L.M. Villada. High order numerical schemes for one-dimension non-local conservation laws. *SIAM J. Sci. Comput.*, 40(1) (2018), A288-A305.
- [5] F.A. Chiarello, P. Goatin and E. Rossi. Stability estimates for non-local scalar conservation laws. *Nonlinear Anal. Real World Appl.*, 45 (2019), 668-687.
- [6] F.A. Chiarello, P. Goatin and L.M. Villada. Lagrangian-Antidiffusive Remap schemes for non-local multi-class traffic flow models. *Comput. Appl. Math.*, 39, 60 (2020).
- [7] P. Goatin, D. Inzunza and L.M. Villada. Nonlocal macroscopic models of multi-population pedestrian flows for walking facilities optimization. Preprint hal-04191630.
- [8] P. Goatin and E. Rossi. Well-posedness of IBVP for 1D scalar non-local conservation laws. *Z. Angew. Math. Mech.*, 99(11) (2019).

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