

Dixièmes Journées Franco-Chiliennes d’Optimisation
INSA Rouen Normandie, Rouen, France
8-11 July 2025

**OPTIMAL CONTROL IN WASSERSTEIN SPACES WITH
APPLICATIONS TO NEURAL ODES**

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The presentation will begin with a brief overview of necessary optimality conditions for control problems in Wasserstein spaces. This involves the development of for a Bolza optimal control problem governed by a non-local continuity equation. In the second part, we investigate a specific instance of this setting that highlights a strong connection with neural ordinary differential equations (neural ODEs). In this model, the control variable plays the role of network parameters, and the evolution of probability measures mirrors the forward pass of a neural network. Numerical examples will be presented to illustrate the performance and stabilization process of the approach in some scenarios.

REFERENCES

- [1] F. Urrea, H. Zidani: *A Pontryagin Maximum Principle for State-Constrained Control Problems in Wasserstein Spaces*, 2025 (Submitted)
- [2] P. Marion, Y. Wu, M. Eli Sander, G. Biau: *Implicit regularization of deep residual networks towards neural ODEs*, The Twelfth International Conference on Learning Representations, 2024.

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