

Occupation measure relaxations for optimal control

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In this talk, we address the problem of relaxation of optimal control problems from an occupational measure relaxation viewpoint. The method consists in replacing the dynamics by a continuity equation in the space of measures and to formulate the optimal control problem as a Linear Programming (LP) problem in the latter space. This formulation then allows to transform the problem into an optimization problem on the moments, so that the numerical resolution method based on the moment-SOS aka Lasserre hierarchy can be adapted to this case [3]. We will show at which extend this resolution method can be applied to systems having some specific features such as symmetries [2] or parametric uncertainties [1], and we will illustrate numerically our methods on the optimal inversion of qubits. This presentation is based on works is a collaboration with Didier Henrion, Milan Korda, Victor Magron, Benoît Bonnet and Emilien Flayac.

- [1] N. Augier, B. Bonnet, E. Flayac. *Ensemble optimal control via measure relaxations*. In preparation, 2024.
- [2] N. Augier, D. Henrion, M. Korda, V. Magron. *Symmetry reduction and recovery of trajectories of optimal control problems via measure relaxations*. arXiv preprint arXiv :2307.03787, 2023.
- [3] J. B. Lasserre, D. Henrion, C. Prieur, E. Trélat. *Nonlinear optimal control via occupation measures and LMI-relaxations*. SIAM J. Control Optim., **47(4)**, 1643–1666, 2008. doi :10.1137/070685051.