

# MULTI-SCALE MODELING AND CONTROL OF SELF-ORGANIZING SYSTEMS

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**ABSTRACT.** In this talk I will review some results on the multi-scale description and control of multi-agent systems, with applications in social behavior like herding, crowds and opinion consensus dynamics. In particular I will be focused on the optimal control of these systems, through an external policy maker or few internal agents both aiming to steer a large ensemble of agents towards a desired status. In order to deal with the control of a system of many particles I will introduce a general framework for the derivation of a kinetic description, based on a binary approximation of the original microscopic dynamic and a Boltzmann-type equation. The binary approximation will suggest also an efficient stochastic method for the simulation of the constrained dynamic of the kinetic density. Several numerical simulations show the efficacy of the control techniques in both microscopic and mesoscopic settings.

**Keywords:** Multi-agent systems, optimal control, Boltzmann equation, Vlasov equation, Monte-Carlo methods.

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