Proximal methods for Mean Field Games with local couplings

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Abstract. In this talk we address the numerical approximation of Mean Field Games with local couplings. For power-like Hamiltonians, we consider both unconstrained and constrained stationary systems with density constraints in order to model hard congestion effects. For finite difference discretizations of the Mean Field Game system, we follow a variational approach. We prove that the aforementioned schemes can be obtained as the optimality system of suitably defined optimization problems. In order to prove the existence of solutions of the scheme with a variational argument, the monotonicity of the coupling term is not used, which allow us to recover general existence results. Next, assuming next that the coupling term is monotone, the variational problem is cast as a convex optimization problem for which we study and compare several proximal type methods. These algorithms have several interesting features, such as global convergence and stability with respect to the viscosity parameter, which can eventually be zero. We conclude by presenting numerical experiments assessing the performance of the proposed methods. In collaboration with L. Briceo-Arias (Valparaso, CL) and F. J. Silva (Limoges, FR).