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Regularity theory for time dependent mean-field games

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Resumo

In this talk, we present a series of results on the existence of smooth solutions for time dependent mean-field games systems (MFG, for short). First, we consider a power-like dependence on the measure and Hamiltonians satisfying both sub and super-quadratic growth conditions. In the sub-quadratic case, this is achieved by combining a Gagliardo-Nirenberg type of argument with a new class of polynomial estimates for solutions of the Fokker-Planck. For the super-quadratic setting, we recur to a delicate argument based on the non-linear adjoint method. In the sequel, we investigate logarithmic couplings, which introduce several mathematical challenges. In order to by-pass these difficulties, we recur to the concavity properties of the logarithmic function, combined with the structure of the Fokker-Planck equation. This yields uniform estimates for the coupling in suitable Lebesgue spaces. These build upon the Lipschitz regularity for the Hamilton-Jacobi equation to produce classical solutions under certain restrictions on the growth regime of the Hamiltonian. Minor extensions and general ideas on applications of our results close the talk. This is based on a series of joint works with D. Gomes and H. Sánchez-Morgado.