Seminário de sistemas dinâmicos e estocásticos

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A regularity method for quantitative lower bounds on the Lyapunov exponent for SDEs: with a proof of chaos for Lorenz 96

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Resumo:

A positive Lyapunov exponent is a hallmark of chaos in dynamical systems. Rigorous proofs of positivity of the Lyapunov exponent for deterministic systems appear to be out of reach even for relatively simple dynamical systems due to the difficulty of estimating the probability of certain degeneracies. The addition of a small amount of noise to a system can aid greatly in estimating these degeneracies and positivity of the Lyapunov exponent can be reduced to ruling out a fairly strong rigidity property for a stationary measure on projective space. Such arguments, however, are inherently soft and give very little in the way of an estimate of the size of the Lyapunov exponent, which is important (for instance) in understanding the transition to chaos in systems with weak dissipation. In this talk I will discuss a new method using an identity connecting the top Lyapunov exponent of an SDE on a Rienmannian manifold to a degenerate Fisher Information functional of a certain stationary measure on the sphere bundle. Using new L^1 hypoelliptic estimates we deduce a quantitative coercive lower bound on the Lyapunov exponent in terms of a non-degenerate (local) fractional Sobolev norm of this stationary measure. As an application, we give the first proof of chaos of the Lorenz 96 model when the dissipation is taken small enough. This is joint with Alex Blumenthal and Jacob Bedrossian.

Data: 02/10 - 11:00 (GMT-3) - Via Zoom - Meeting ID: 965 9547 0841 - Passcode: 367630

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