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SEMINÁRIO DE BIOMATEMÁTICA

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The Dynamical Geometry and Control of Epidemic Extinction

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Abstract:

The control and eradication, or fade-out, of infectious diseases is a penultimate goal for improving public health. In order to promote and design control methods, such as vaccination and treatment, one must determine how the disease spreads dynamically. However, modeling the dynamics of an outbreak includes many complicating features, such as deterministic and stochastic chaotic-like behavior. Such complicated dynamics can enhance the probability of extinction. In large populations, although extinction occurs with probability one, extinction is considered a rare event which maximizes the probability of disease fade-out.

In this talk, we show that the path to extinction possesses a maximal sensitivity to initial conditions which is similar to local measures of chaotic behavior, and may be quantified by computing finite time Lyapunov exponents. As a result, the extinction path emerges naturally from the underlying dynamical geometry and may be constructed explicitly for stochastic epidemics. The theory will be applied to several stochastic epidemiological models, along with random control strategies to enhance disease extinction.

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