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CIDMA
CENTRO DE I&D EM MATEMÁTICA E APLICAÇÕES
CENTER FOR R&D IN MATHEMATICS AND APPLICATIONS

# SEMINAR

## Grupo de Análise Funcional e Aplicações
## Functional Analysis and Applications Group

# Functional analytic methods in the study of infectious disease models

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### Abstract

Infectious disease models naturally generate nonlinear dynamical systems exhibiting positivity constraints, threshold phenomena, and stability transitions. This talk considers a representative compartmental epidemic model to demonstrate how functional analytic tools play a fundamental role in qualitative analysis.
Existence and uniqueness of solutions are established, together with positivity, boundedness of trajectories, and characterization of invariant regions. The basic reproduction number is derived via the next-generation operator framework and interpreted as the spectral radius of a positive operator. Local and global stability results for both disease-free and endemic equilibria are discussed using spectral analysis and Lyapunov techniques. Sensitivity analysis is briefly addressed to highlight the influence of parameters on threshold behavior.
Extensions to delay, age-structured, and stochastic epidemic systems are outlined, emphasizing their formulation in infinite-dimensional spaces and their connections to semigroup theory and operator methods.

**Room Sousa Pinto**
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