WEBINAR

Grupo de Análise Funcional e Aplicações
Functional Analysis and Applications Group

COVID-19: mathematical modelling, optimal control and complex network of a SAIRP model

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Abstract

In this seminar, we propose a compartmental SAIRP mathematical model, for the transmission dynamics of SARS-CoV-2, given by a system of ordinary differential equations, which is fitted to the number of active infected individuals with COVID-19 in Portugal. We apply optimal control theory to the SAIRP model, to maximize the number of people returning to "normal life" and minimizing the number of active infected individuals with minimal economical costs while warranting a low level of hospitalizations. After the SAIRP model is generalized, considering piecewise constant parameters, and we construct a complex network of dynamical systems, in order to take into account the mobilities of individuals, which are known to play a decisive role in the dynamics of the epidemic. We prove the existence of pseudo-periodic solutions of the epidemic model and analyze its relation with multiple epidemic waves in COVID-19 pandemic. The model with piecewise constant parameters is calibrated in order to fit with the real data of the COVID-19 active infected individuals in six regions of Portugal mainland. Through numerical simulations, we explore the effect of the topology of the network on the dynamics of the epidemics (disposal of connections and coupling strength) and identify which type of topology minimizes the level of infection of the epidemic.

References

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