Universidade de São Paulo
Instituto de Física de São Carlos

XI Semana Integrada do Instituto de Física de São Carlos

Livro de Resumos

São Carlos
2021

Semana Integrada do Instituto de Física de São Carlos

SIFSC 11

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Ficha catalográfica elaborada pelo Serviço de Informação do IFSC

Semana Integrada do Instituto de Física de São Carlos
(11: 06 set. - 10 set. : 2021: São Carlos, SP.)
Livro de resumos da XI Semana Integrada do Instituto de Física de São Carlos/ Organizado por João H. Melo Inagaki [et al.]. São Carlos: IFSC, 2021.
412 p.
Texto em português.
1. Física. I. Inagaki, João H. de Melo, org. II. Titulo

ISBN 978-65-993449-3-0 CDD 530

PG41

Modeling the effects of social distancing on the large-scale spreading of diseases

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Infectious diseases that transmit from human to human are subject to strong influence from behavioral responses by the population.(1) Non-pharmaceutical interventions (NPIs) aimed at reducing the interactions between individuals can be implemented, being specially useful when pharmaceutical measures, such as vaccines, are not available. One example of the former kind of measures is social distancing, which can be either policy-driven or can arise endogenously in the population as a consequence of the fear of infection. However, if NPIs are lifted before the population reaches herd immunity, further reintroductions of the pathogen would lead to secondary infections. In this work, we use analytical and computational modeling tools to study the effects of different social distancing schemes on the large scale spreading of diseases. Specifically, we generalize a previously proposed model for social distancing (2) to be applied at the subpopulation level of metapopulations (3), considering short and long term strategies that are fed with local or global information about the epidemics. For the epidemic component, we employ a *Susceptible-Infectious-Removed* (SIR) model, and for mobility we use a synthetic random geometric network (RGN) with links weighted proportionally to the populations at both ends. We show that, with the proposed formulation, different model ingredients might lead to very diverse outcomes in different subpopulations. We also use convenient metrics to compare the efficiency between local and global strategies, showing that each one may be more appropriate in different scenarios. Finally, we evaluate the consequences of suddenly lifting the NPI mechanisms, showing that multiple global and local outbreaks may occur. Our results suggest that there is not a unique answer to the question of whether contention measures are better implemented and managed locally or globally and that model outcomes depend on how the full complexity of human interactions is taken into account.

Palavras-chave: Epidemic spreading. Metapopulation. Social distancing.

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