UNIVERSIDADE DE LISBOA
CENTRO DE MATEMÁTICA E APLICAÇÕES FUNDAMENTAIS
Av. Prof. Gama Pinto 2, 1649-003 LISBOA, PORTUGAL   Tel. (351) 217 904 700 FAX (351) 217 954 288

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SEMINÁRIO DE ANÁLISE E EQUAÇÕES DIFERENCIAIS

Dia 7 de Março (quinta-feira), às 13h30, na Sala B3-01

Lyapunov function techniques to analyze the global stability of some epidemic models

Yoshiaki Muroya

(Waseda University, Tokyo, Japan)

Abstract:

Recently, the global asymptotic stability for endemic equilibrium of not only from a SIR model with nonlinear incidence rate by Korobeinikov [1] to a multi-group SIRS epidemic model by Guo, Li and Shuai [3] with graph theory but also a delayed SIR epidemic model by McCluskey [2] were completely solved by the threshold parameter R_0 named the reproduction number of model, and then it becomes one of very interesting research problems how to establish new sufficient conditions by Lyapunov function techniques for the endemic equilibrium of related epidemic models to be globally asymptotically stable.

In this seminar, we first give a brief overview on some Lyapunov function techniques not only with nonlinear incidence rates and delays in McCluskey [2] which continue to well known techniques how to obtain a sufficient condition on an SIRS epidemic model to be globally asymptotically stable, but also without delays for SIS, SEIS and SIRS epidemic models with bilinear incidence rate, nonlinear incidence rate or varying total population size (cf. Korobeinikov [1]).

Then, we will show how to obtain sufficient conditions without graph theory in Guo, Li and Shuai [3] for the global stability of endemic equilibrium of multi-group SIR epidemic models which have not only an exchange of individuals between patches through migration but also cross patch infection between different groups. This partially generalizes the recent result of an algebraic approach in Li, Xiao, Zhang and Yang [4]. Similarly, we have a result for multi group SIRS model with varying population sizes (see Muroya *et al.* [5]).

References

[1] A. Korobeinikov, Global properties of infectious disease models with nonlinear incidence , *Bull. Math. Biol.* **69** (2007) 1871-1886.

[2] C. C. McCluskey, Complete global stability for an SIR epidemic model with delay-Distributed or discrete. *Nonlinear Analysis RWA* **11** (2010) 55-59.

[3] H. Guo, M. Y. Li and Z. Shuai, Global stability of the endemic equilibrium of multigroup SIR epidemic models, *Canadian Appl. Math. Quart.* **14** (2006) 259-284.

[4] J. Li, Y. Xiao, F. Zhang and Y. Yang, An algebraic approach to proving the global stability of a class of epidemic models, *Nonlinear Analysis RWA* **13** (2012) 2006-2016.

[5] Y. Muroya, Y. Enatsu and T. Kuniya, Global stability for a multi-group SIRS epidemic model with varying population sizes, *Nonlinear analysis RWA* **14** (2013) 1693-1704.

Joint work with Yoichi Enatsu (Waseda University) and Toshikazu Kuniya (Tokyo University)

Local:
Instituto para a Investigação Interdisciplinar
da Universidade de Lisboa
Av. Prof. Gama Pinto, 2
1649-003 Lisboa

HOSP. SANTA MARIA

Av. Prof. Gama Pinto

Entrada

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