UNIVERSITÀ DI TRENTO
Dipartimento di Matematica

DOTTORATO

CYCLE 35th
ORAL DEFENCE OF THE PHD THESIS

Monday 23 January 2023 – at 3.00 pm

Physics Seminar Room

The event will take place in presence and online through the ZOOM platform.
To get the access codes please contact the secretary office

Sara Sottile

PhD Student in Mathematics

Different approaches to epidemics modelling: from theoretical analysis to real data

Abstract:
This work aims at presenting different approaches to epidemics modelling. It consists of two main topics, which cover both theoretical and computational approaches to the development and analysis of mathematical models of infectious diseases.
The first half regards the formulation and the analysis of SAIRS (Susceptible - Asyptomatics infected - Infected symptomatic - Recovered - Susceptible) epidemic models, including the possibility of vaccination. The model is formulated as a system of ordinary differential equations (ODEs), for which we provided a complete global stability analysis, combining two different approaches: the classical Lyapunov stability theorem, and a geometric approach, which generalises the Poincaré-Bendixon theorem. Afterwards, the model has been generalised using heterogeneous networks, which may describe different groups of individuals or different cities. For this model, the global stability analysis has been developed using the graph-theoretic approach to find Lyapunov functions.
The second part of the thesis covers simulations based approaches to modelling heterogeneous humans interactions in epidemics. The first example we provide is an application with synthetic data. We investigate a stochastic SIR (Susceptible - Infected symptomatic - Recovered) dynamics on a network, by using a specialised version of the Gillespie algorithm.
The other two examples we show consist of real data applications. Both regard the cost-benefit analysis of the introduction of new influenza vaccines. Both analyses have been performed using a multi-group SEIR (Susceptible - Exposed - Infected - Recovered) epidemiological model divided by age classes.

Supervisor:
Andrea Pugliese (University of Trento)

CONTATTI
Staff di Dipartimento - Matematica
tel. 0461 281508-1625-1701-3786
phd.maths@unitn.it
www.maths.unitn.it