

WORKSHOP ON SYMMETRY AND DYNAMICS: ON THE OCCASION OF ISABEL LABOURIAU'S 60th

June 13, 2014

All talks at Room 0.31, Mathematics building, FCUP

TIMETABLE

9.30-10.00	Ana Dias	Opening Session
10.00-10.40	Alexandre Rodrigues	Symmetry breaking and heteroclinic tangencies
10.40-11.00	Coffee Break	
11.00-11.40	Manuela Aguiar	Networks and networks
11.40-12.20	Ana Rodrigues	Periodic orbits for real planar polynomial vector fields of degree n having n invariant straight lines
12.20-14.15	Lunch - Círculo Universitário	
14.15-14.55	Gabriela Gomes	Hidden heterogeneity in infectious disease epidemiology
14.55-15.35	Carla Pinto	From my (pH)D day on...
15.35-16.05	Stella Abreu	Dos ciclos heteroclínicos à redução do espaço de fase em campos de vetores simétricos
16.05-16.20	Coffee Break	
16.20-17.00	Eliana Pinho	Simetria, padrões e bias passé
17.00-17.50	Technological Session	Technological aid in modern research
17.50-18.15	Sofia Castro	Closing Session
18.15 -	"The Party"	

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ABSTRACTS

The abstracts are listed respecting the sequence in the program.

Ana Dias, FCUP and CMUP

Opening Session

Crossing paths with Professor Isabel Labouriau...

Alexandre Rodrigues, FCUP and CMUP

Symmetry breaking and heteroclinic tangencies

In this talk, we revive some topics on homoclinic dynamics and study some global aspects of the bifurcation of an equivariant family of volume-contracting vector fields on the threedimensional unitary sphere. The vector fields have two saddle-foci of different Morse index, connected in a cycle that is structurally stable within a class of equivariant vector fields. The cycle contains a two-dimensional connection that persists as a transverse intersection of invariant surfaces under partial symmetry-breaking. Gradually breaking the symmetry in a two-parameter family we get a wide range of dynamical behaviour: an attracting periodic trajectory; other heteroclinic trajectories; homoclinic orbits; n -pulses; suspended horseshoes and cascades of bifurcations of periodic trajectories near an unstable homoclinic cycle of Shilnikov type and linked homoclinic orbits. We also investigate the mechanism of the emergence of heteroclinic tangencies coexisting with transverse connections. We find persistent suspended hyperbolic horseshoes accompanied by attracting periodic trajectories with long periods. (Joint work with Isabel Labouriau.)

Manuela Aguiar, FEP.UP and CMUP

Networks and networks

In this talk I will present the works on heteroclinic networks and on coupled cell networks where I have collaborated trying to sketch a network of relations between them.

Ana Rodrigues, University of Exeter

Periodic orbits for real planar polynomial vector fields of degree n having n invariant straight lines

In this talk, we will study the existence and non-existence of periodic orbits and limit cycles for planar polynomial differential systems of degree n having n real invariant straight lines taking into account their multiplicities. (Joint work with Jaume Llibre.)

Gabriela Gomes, Instituto Gulbenkian de Ciência

Hidden heterogeneity in infectious disease epidemiology

Year after year, decade after decade, the object of my research evolves, punctuated by dramatic shifts, but the approaches are remarkably conserved. All traces back to the 1986/87 edition of that fabulous Bifurcation Theory course that Professor Isabel Labouriau lectured to 4th year students in Applied Mathematics, at the University of Porto.

My current research seeks to empower infectious disease studies with the identification of dimensions where hidden phenomena can be uncovered. With my students, postdocs, and collaborators, theory and methods are applied to the design and analysis of specific host-pathogen studies, resulting in new protocols to assess intervention strategies. Our focus has two main components:

a) *Pathogen-dose dimension*. The impact of interventions against infectious diseases (such as vaccines, or other preventive or therapeutic tools) depends on the intensity of ongoing transmission (pathogen-dose dimension). Individual protection, on the other hand, varies between hosts, reflecting underlying biological variation and affecting population level protection. Owing to the nature of resistance mechanisms, distributions of protection entangle with pathogen dose in a way that can be decoupled by adequately representing the dose dimension. As a result, a global measure of protection that applies across epidemiological settings is extracted.

b) *Pathogen-evolution dimension*. Most pathogens have associated a range of syndromes than can range from no symptoms to severe disease. Vaccination can reduce host susceptibility to infection or severity of symptoms. While surveillance systems tend to only capture the more symptomatic end of the spectrum, models for transmission systems must somehow represent the entire range. To the extent that epidemiological processes affect pathogen evolution, genetic sequencing is informative for the epidemiological model, in general, and for the inference of asymptomatic transmission, in particular.

Specific case studies in different host-pathogen systems are adopted to test and refine the representation of pathogen dose and evolution in mathematical models and study designs, while accurately monitoring host responses, over those axes, in intervention and non-intervention individuals. In the first instance, this provides freedom for quantitative and qualitative properties of the intervention mode of action to unfold. Further downstream in the modeling process, it allows for better anticipation of community strategies to face future outbreaks of infectious diseases and lead to more realistic impact assessment.

Carla Pinto, ISEP-IPP

From my (pH)D day on...

In this talk we review some of the work done during and after my (Ph)D day. The main focus will be on systems of ordinary differential equations with symmetry.

Stella Abreu, ISEP-IPP

Dos ciclos heteroclínicos à redução do espaço de fase em campos de vetores simétricos

Na primeira parte desta intervenção farei uma breve referência ao papel de Isabel Labouriau no meu percurso profissional, focando a influência decisiva no mestrado e a orientação da tese de doutoramento (em conjunto com Sofia Castro). Em seguida, falarei do tema estudado no mestrado, ciclos heteroclínicos em sistemas dinâmicos contínuos com simetria, e de como motivou o tema de doutoramento. Abordarei o estudo sobre grupos de Lie compactos que foi feito no doutoramento, e a decomposição de campos vetores simétricos.

Eliana Manuel Pinho, UP

Simetria, padrões e bias passé

“Nesta tese descrevemos como se modifica a simetria de uma função com a projecção ou a restrição – dois métodos que permitem baixar a dimensão do seu domínio.” Este é o início da tese de doutoramento *Symmetries of Projected Symmetric Patterns* orientada pela Isabel. Vou apresentar alguns resultados deste trabalho, bem como a motivação para iniciar o seu estudo.

O bias passé é o nome dado a um tipo de abóbada sobre uma travessia enviesada. É a materialização de uma superfície regrada, presente nos tratados de arquitectura e estereotomia desde o século XVI, que acompanhou a evolução das linguagens de representação e, em particular, o desenvolvimento da geometria descritiva. Vou contar, através do bias passé em pedra, um pouco da intrincada história que une arquitectura, geometria e as técnicas de comunicação necessárias para chegar a uma estrutura construída, e que é o meu objecto de estudo actual.

Technological Session: Sype session

Technological aid in modern research

A brief account of modern mechanisms related to Isabel Labouriau’s research

Participants:

Begoña Alarcón, Universidade Federal Fluminense, Brasil

Maria Leite, University of Toledo, USA

Míriam Manoel, University of São Paulo, Brasil

Maria Aparecida Ruas, University of São Paulo, Brasil

Sofia Castro, FEP.UP and CMUP

Closing Session

A collaborative path with Isabel Labouriau...