Low dimensional dynamical systems

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Descrição da proposta de sessão paralela: Many phenomena in our physical world are modelled by a dynamical system. The field had its origins with the work of Poincaré when realising that it is sometimes not possible to solve analytically a Differential Equation but instead we can study its qualitative behaviour. In this section we will have three major Portuguese specialists in the field, discussing the topic from three different perspectives.

Orador 1 - Ana Cristina Moreira Freitas, Universidade do Porto, Faculdade de Economia e Centro de Matemática, The extremal index and the cluster size for dynamical systems

Abstract: We consider stochastic processes arising from dynamical systems by evaluating an observable function along the orbits of the system and analyse the possible extreme value laws for these stochastic processes. In this context, the existence of an extremal index less than 1 is associated to the occurrence of periodic phenomena. For generic points, the exceedances, in the limit, are isolated and occur at Poisson times. But around periodic points the picture is different: the respective point processes of exceedances converge to a compound Poisson process, so instead of isolated exceedances, we have entire clusters of exceedances occurring at Poisson times with a geometric distribution ruling its multiplicity. The extremal index usually coincides with the reciprocal of the mean of the limiting cluster size distribution. Here, we build dynamically generated stochastic processes with an extremal index for which that equality does not hold. The mechanism we use is based on considering observable functions maximized at at least two points of the phase space, where one of them is an indifferent periodic point. For the second point at which the observable function is maximized we consider either a periodic or a nonperiodic point. We explore two such examples and, for each of them, we compute the extremal index and present the corresponding cluster size distribution.

Orador 2 - Pedro Duarte, Faculdade de Ciências da Universidade de Lisboa, Lyapunov exponents of random GL(2,R) cocycles.

Abstract: In this context of H. Furstenberg's theory of random products of matrices we relate the regularity of the Lyapunov exponent with the regularity of its stationary

measures, a connection established in a recent joint work with Ao Cai, Jamerson Bezerra, Catalina Freijo and Silvius Klein.

Orador 3 - Jorge Milhazes Freitas, Universidade do Porto, Faculdade de Ciências e Centro de Matemática, Enriched functional limits for ergodic sums

Abstract: We present a general framework for weak convergence to decorated Lévy processes in enriched spaces of cádlág functions for vector-valued processes arising in deterministic systems. Applications include uniformly expanding maps and unbounded observables as well as nonuniformly expanding/hyperbolic maps with bounded observables. The latter includes intermittent maps and dispersing billiards with flat cusps. In many of these examples, convergence fails in all of the Skorohod topologies. Moreover, the enriched space picks up details of excursions that are not recorded by Skorohod or Whitt topologies.