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The 8th International Scientific Conference on Physics and Control (PhysCon2017) will take place at University of Firenze, Didactic Plexus "Capponi", via Gino Capponi 9, Firenze, Italy. The conference will be hosted in the historical site of the Chemistry and Pharmacy Department "Ugo Schiff ". PhysCon2017 will be from 17th to 19th July, 2017.

The Short Course on Basics of Physics of Control and Recent Advancements

Lecturers:
A. Fradkov (Inst. for Problems of Mech. Eng., St. Petersburg, Russia)
J. Kurths (Humboldt University, Berlin, Germany)
E. Schöll (Technische Universität, Berlin, German)
S. Boccaletti (ISC-Institute for Complex Systems, Italy)

Among the **keynote speakers** are:

M. Frasca (Università di Catania, Italy)
J. Gallas (Federal University of Paraiba, Brasil)
J. Bechhoefer (Simon Fraser University, Canada)

PhysCon2017 will focus on the borderland between Physics and Control with emphasis on both theory and applications.
Topics will include (but will not be limited to):

- Nonlinear dynamics,
- Controlled systems in physics,
- Dynamics and control of complex networks,
- Self-organization and complexity,
- Micro and nano-technologies,
- Control in thermodynamics,
- Communication and transportation,
- Environmental and earth sciences,
- Control of ecosystems and climate,
- Mathematics,
- Chemistry,
- Sociology,
- Biology and medicine,
- Engineering methods and applied fields

The Physcon 2017 will also include the following Special Sessions/Minisimposia:

- Algebraic aspects of control of dynamical systems and applications
- Analogies between long-delayed and spatially extended systems
- Chaotic and Complex Dynamics and its Applications
- Control of self-organized patterns in complex networks
- Control, State Estimation, and Optimization of Dynamical Systems
- Dynamics and regulation of complex interaction models
- Multistability and Its Control
- Quantum optimal control

After the peer review process, all accepted papers for the conference are eligible for inclusion in the IPACS Open Access library.

IMPORTANT DEADLINES

Deadline for Paper Submission	**30 April 2017**
Notification of Acceptance	**15 May 2017**

http://www.physcon2017.com/

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Short Couses on Basics of Physcis of Control and Recent Advancements

"Cybernetical Physics-2017"

Prof. Alexander Fradkov

The talk is dedicated to a new research field – cybernetical physics, studying physical systems by cybernetical methods.

Main areas of activity in cybernetical physics during last decade will be outlined, such as control of oscillatory and chaotic behavior, control of resonance and synchronization, control in thermodynamics, control of distributed systems and networks.

Quenching and Reviving Oscillations in Complex Networks

Jürgen Kurths

Potsdam Institute for Climate Impact Research and Humboldt University Berlin, Institute of Physics, Germany, Juergen.Kurths@pik-potsdam.de

Abstract

Coupled oscillators are shown to experience two structurally different oscillation quenching types: amplitude death (AD) and oscillation death (OD). We demonstrate that both AD and OD can occur in one system and find that the transition between them underlies a classical, Turing-type bifurcation, providing a clear classification of these significantly different dynamical regimes.

In certain circumstances, harmful oscillations are undesirable which should be suppressed. However, oscillatory behavior is an essential determinant for proper functioning of various physical and biological processes in a wide variety of natural systems. Here we propose a rather simple and generic scheme to revoke both AD and OD in coupled dynamical networks of nonlinear oscillators. Specifically, by introducing a simple feedback factor in the diffusive coupling, we show that it can destabilize stable (in)homogeneous steady states to restore dynamic behaviors of coupled systems.

By introducing a processing delay in the coupling, we find that it can effectively annihilate the quenching of oscillation, amplitude death (AD), in a network of coupled oscillators by switching the stability of AD. It revives the oscillation in the AD regime to retain sustained rhythmic functioning of the networks, which is in sharp contrast to the propagation delay with the tendency to induce AD. This processing delay-induced phenomenon occurs both with and without the propagation delay. We demonstrate this approach in experiments with an oscillatory chemical reaction and with electronic circuits.

W. Zou, D.V. Senthilkumar, M. Zhan, and J. Kurths, Phys. Rev. Lett. 111, 014101 (2013)

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W. Zou et al., Nature Commun. 6, 7709 (2015)

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"Controlling partial synchronization patterns: chimera states"

Eckehard Schöll

Institut für Theoretische Physik, Technische Universität Berlin,

Hardenbergstr. 36, 10623 Berlin, Germany

Synchronization phenomena in nonlinear dynamical networks are of great importance in many areas ranging from physics andchemistry to biology, neuroscience, socio-economic systems, and engineering. Chaos synchronization of lasers, for instance, may lead to new secure communication schemes. The synchronization of neurons is believed to play a crucial role in the brain under normal conditions, for instance in the context of cognition, learning, and sleep, and under pathological conditions such as epilepsies and tremor. Synchronization of power grids is essential for their operation.

Recent interest has focussed on more complex partial synchronization patterns like chimera states, i.e., symmetry-breaking states of partially coherent and partially incoherent behavior.

Chimera states are intriguing spatio-temporal patterns made up of spatially separated domains of synchronized (spatially coherent) and desynchronized (spatially incoherent) behavior, although they arise in networks of completely identical units. In Greek mythology, the chimera is a fire-breathing monster composed of incongruous parts, i.e., a lion's, a goat's, and a snake's head.

We show that a plethora of chimera patterns arise if one goes beyond the Kuramoto phase oscillator model, and considers coupled phase and amplitude dynamics, and more complex topologies than a simple one-dimensional ring network. For the FitzHugh-Nagumo system, the Van der Pol oscillator, and the Stuart-Landau oscillator with symmetry-breaking coupling various multi-chimera patterns including amplitude chimeras and chimera death occur.

We review the control of chimera patterns by a subtle interplay of dynamics, topology, feedback, and delay.

Bellerophon States: Coexistence of Quantized, Time Dependent,

Clusters in Globally Coupled Oscillators

Stefano Boccaletti

From rhythmic physiological processes to the collective behaviors of technological and natural networks, coherent phases of interacting oscillators are the foundation for the emergence of the system's cooperative functioning. We unveil the existence of a new of such states, occurring in globally coupled nonidentical oscillators in the proximity of the point where the transition from the system's incoherent to coherent phase converts from explosive to continuous. In such a state, oscillators form quantized clusters, where they are neither phase- nor frequency-locked. Oscillators' instantaneous speeds are different within the clusters, but they form a characteristic cusped pattern and, more importantly, they behave periodically in time so that their average values are the same. Given its intrinsic specular nature with respect to the Chimera states, the phase is termed the Bellerophon state. We provide analytical and numerical description of the microscopic and macroscopic details of Bellerophon states, thus furnishing practical hints on how to seek for the new phase in a variety of experimental and natural systems.

Authors:

Stefano Boccaletti, CNR, Italy (speaker)

Hongjie Bi, East China Normal University, China,

Xin Hu, Chinese Academy of Sciences, China,

Xingang Wang, National University of Singapore, Singapore,

Yong Zou, East China Normal University, China,

Zonghua Liu, East China Normal University, China,

Keynote Speakers

Remote synchronization in complex networks

Mattia Frasca

Synchronization is probably one of the most fascinating collective phenomenon appearing in networks of coupled oscillators. In this talk I will discuss the main results on a particular type of synchronization named remote, as units not directly connected exhibit some form of coordination while remaining unsynchronized with the intermediate nodes. I will first introduce experiments on motifs of few nodes and then discuss the phenomenon in larger topologies. I will also compare the phenomenon with other types of synchronization such as cluster and relay synchronization and, finally, provide some insights on the control techniques which can be designed exploiting the mechanisms of remote synchronization.

"History of nonlinear oscillations theory"

Jean-Marc Ginoux

Laboratoire LSIS, CNRS, UMR 7296,

Archives Henri Poincaré, CNRS, UMR 7117

Abstract. "It is admitted that the nonlinear oscillations theory was developed from the end of the nineteenth century and gave rise in the middle of the forties to dynamical systems theory. If this latter has been extensively studied by many historians of sciences, it was not the case till recently for the nonlinear oscillations theory. So, the aim of this talk is to present a new book which investigates birth and developments of the nonlinear oscillations theory and more particularly relaxation oscillations.

Some fundamental steps of its elaboration will be highlighted during this presentation such as the rediscovery of Poincaré's forgotten lectures of 1908 in which he made, twenty years before Andronov, a practical application of the concept of limit cycle to the wireless telegraphy. It will be also

shown that the French engineer André Blondel stated in 1919 the so-called Van der Pol equation one year before him and that Van der Pol didn't immediately recognize in the graphical integration of his equation a limit cycle of Poincaré. The discovery of the very first International Conference on Nonlinear Oscillations held in Paris from January 28-30, 1933 will be also presented. Thus, the forgetting of Poincaré's lectures, the fact that in many works such as those of Alfred Liénard in 1928 no connection with Poincaré's works has been made, the forgetting of this first Paris nonlinear conference will lead to duss again the question of Poincaré's legacy in France.

Thermodynamics of information and control: the twin legacies of James Clerk Maxwell

John Bechhoefer
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Canada

Abstract: One hundred and fifty years ago, Maxwell's demon was first posed as a fundamental challenge to the newly developed field of statistical physics. Just two months later, Maxwell's paper "On governors" gave the first analysis of a feedback system. These two foundational works reflect the fundamental and practical aspects of control theory. Here, I will present an experiment that unites the two: using feedback to create "impossible" dynamics, we make a Maxwell demon that can reach the fundamental limits to control set by thermodynamics. We test—and then extend—Rolf Landauer's 1961 prediction that information erasure requires at least as much work as can be extracted from a system by virtue of information. These fundamental thermodynamic limits are benchmarks for evaluating the performance of practical information engines, such as those active within cells and other complex systems.