DY 25: Nonlinear Stochastic Systems

Time: Tuesday 15:00–16:15 Location: BH-N 128

DY 25.1 Tue 15:00 BH-N 128

Stability induced by PT-symmetry breaking in stochastic oscillators — •Mirko Lukovic[1], Patrick Navez[2], Theo Geisel[1,3], and Giorgos Tsironis[2,4] — [1]Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — [2]Crete Center for Quantum Complexity and Nanotechnology, Heraklion, Greece — [3]Institute for Nonlinear Dynamics, University of Goettingen, Germany — [4]Department of Physics, University of Crete, Heraklion, Greece

We investigate the effects of dichotomous noise added to the harmonic oscillator in the form of stochastic time-dependent gain and loss phases, whose durations are sampled from two distinct exponential waiting time distributions. We show that this oscillator system is unstable in the special (symmetric) case where the two waiting time distributions are identical and that it stabilizes only after introducing a significant amount of asymmetry (bias), consisting of much longer periods of loss rather than gain. This concept could be applied in the stabilization of light propagation in metamaterials (optical fibres) with random regions of asymmetric active and passive media.

DY 25.2 Tue 15:15 BH-N 128

Noise-controlled bistability in an excitable system with positive feedback — •Justus Alfred Kromer[1], Reynaldo Daniel Pinto[2], Benjamin Lindner[1,3], and Lutz Schimansky-Geier[1,3] — [1]Department of Physics, Humboldt-Universität zu Berlin - Newtonstr. 15, 12489 Berlin, Germany — [2]Laboratório de Neurodinâmica/Neurobiofísica, Universidade de São Paulo - São Carlos, SP, Brazil — [3]Bernstein Center for Computational Neuroscience - Berlin, Germany

We study the interplay between noise and a positive feedback mechanism in an excitable system that generates events. We show that such a system can exhibit a bistability in the dynamics of the event generation (states of low and high activity). The stability of the two states is determined by the strength of the noise such that a change of noise intensity permits complete control over the probabilities with which the two states are occupied. The bistability also has strong implications for the regularity of the event generation. While the irregularity of the interevent interval (short-time variability) and the asymptotic Fano factor of the event count (long-time variability) are limited if the system is only in one of the two states, we show that both measures of variability display giant values if both states are equally likely. The long-time variability is additionally amplified by long-range positive correlations of the interevent intervals.

DY 25.3 Tue 15:30 BH-N 128

Simulating stochastic differential equations using truncated Markov chains — •Rüdiger Kürsten and Ulrich Behn — Institut für Theoretische Physik, Universität Leipzig, Brüderstr. 16 D-04103 Leipzig

Markov chains with detailed balance are widely used to sample high-dimensional distributions, a prominent example is the Monte Carlo simulation. To sample critical phenomena or rare events with high precision modified techniques such as, for example, the multicanonical method are successfully applied. The methods use more or less tacitly a truncated Markov chain where transition probabilities between certain regions of state space are manipulated. Solution trajectories of stochastic differential equations (SDE) can be sampled naively for instance by an Euler-Mayurama scheme. Here we develop an efficient simulation technique for SDEs that is based on a variant of the truncated Markov chain. An extension for systems without detailed balance is proposed.

DY 25.4 Tue 15:45 BH-N 128

One single turbine to estimate fatigue within a wind farm — •Pedro Lind, Ivan Herraez Hernandez, Matthias Wächter, and Joachim Peinke — ForWind, Institute of Physics, Carl von Ossietzky University, 26111 Oldenburg, Germany

We propose a procedure to estimate the fatigue loads on wind turbines, based on a recent framework used for reconstructing data series of stochastic properties measured at wind turbines. Through a standard fatigue analysis, we show that it is possible to accurately estimate fatigue loads in any wind turbine within one wind farm, using only the load measurements at one single turbine and the set of wind speed measurements. Our framework consists of deriving a stochastic differential equation that describes the evolution of the torque at one wind turbine driven by the wind speed. The stochastic equation is derived directly from the measurements and is afterwards used for predicting the fatigue loads at neighboring turbines. Such a framework could be used to mitigate the financial efforts usually necessary for placing measurement devices in all wind turbines within one wind farm.

DY 25.5 Tue 16:00 BH-N 128

1/f noise from the scaling and the nonlinear transformations of the variables — •Bronislovas Kaulakys, Miglius Alaburda, and Julius Ruseckas — Institute of Theoretical Physics and Astronomy, Vilnius University, A. Gostauto 12, LT-01108 Vilnius, Lithuania

Modeling of the low-frequency noise $1/f^{\beta}$ observable in different systems, from physics to financial markets, still remains a challenge. Different models and theories have been proposed for explanation of this phenomenon. Recently, the stochastic model of $1/f^{\beta}$ noise, based on the nonlinear stochastic differential equations has been proposed and analyzed [1]. Here we employ the self-similarity property of the nonlinear transformation of the nonlinear stochastic differential equations [2]. We show that processes with $1/f^{\beta}$ spectrum may yield from the nonlinear transformation of the variable of the widespread processes, e.g., from the Brownian motion, Bessel or similar familiar processes. Analytical and numerical investigations of such techniques for modeling processes with $1/f^{\beta}$ fluctuations will be presented.

[1] J. Ruseckas and B. Kaulakys, Phys. Rev. E **81**, 031105 (2010).
[2] J. Ruseckas and B. Kaulakys, J. Stat. Mech. P06005 (2014).