DY 13: Nonlinear Stochastic Processes

Time: Tuesday 14:15–15:15 Location: MA 004

DY 13.1 Tue 14:15 MA 004

The Nature and Perception of Fluctuations in Human Musical Rhythms — Holger Hennig[1,2,3], Ragnar Fleischmann[1], Anneke Fredebohm[4], York Hagmayer[5], Jan Nagler[1,2], Annette Witt[1,6], Fabian J. Theis[1,6,7], and •Theo Geisel[1,2,6] — [1]Max Planck Institute for Dynamics and Self-Organization, Göttingen — [2]Institute for Nonlinear Dynamics, University of Göttingen — [3]Harvard University, Cambridge, MA, USA — [4]Institute of Psychology, University of Göttingen — [5]Kings College, London, UK — [6]BCCN, Göttingen — [7]Helmholtz Zentrum München

Although human musical performances represent one of the most valuable achievements of mankind, the best musicians perform imperfectly. Musical rhythms are not entirely accurate and thus inevitably deviate from the ideal beat pattern. Nevertheless, computer generated perfect beat patterns are frequently devalued by listeners due to a perceived lack of human touch. Professional audio editing software therefore offers a humanizing feature which artificially generates rhythmic fluctuations. However, the built-in humanizing units are essentially random number generators producing only simple uncorrelated fluctuations.

Here, for the first time, we establish long-range fluctuations as an inevitable natural companion of both simple and complex human rhythmic performances [1]. Moreover, we demonstrate that listeners strongly prefer long-range correlated fluctuations in musical rhythms. Thus, the favorable fluctuation type for humanizing interbeat intervals coincides with the one generically inherent in human musical performances.

[1] Hennig et al., PLoS ONE, 6, e26457 (2011)

DY 13.2 Tue 14:30 MA 004

Phase separation of binary mixtures in thin films: Effects of an initial concentration gradient across the film — •Prabhat K. Jaiswal[1,2], Kurt Binder[1], and Sanjay Puri[2] — [1]Institut für Physik, Johannes Gutenberg-Universität Mainz, Staudinger Weg 7, D-55099 Mainz, Germany — [2]School of Physical Sciences, Jawaharlal Nehru University, New Delhi - 110067, India

We study the kinetics of phase separation of a binary (A,B) mixture confined in a thin film of thickness D by numerical simulations of the corresponding *time-dependent Ginzburg-Landau* model. The initial state consisted of 50% A : 50% B with a concentration gradient across the film, i.e., the average order parameter profile is $\Psi_{\rm av}(z, t = 0) = (2z/D - 1)\Psi_g$, $0 \leq z \leq D$, for various choices of Ψ_g and D. The equilibrium state consists of coexisting A-rich and B-rich domains separated by interfaces oriented perpendicular to the surfaces. However, for sufficiently large Ψ_g, a metastable layered state is formed with a single interface parallel to the surfaces. This phenomenon is explained in terms of a competition between domain growth in the bulk, and *surface-directed spinodal decomposition* that is caused by the gradient. Thus gradients in the initial state can stabilize thin-film morphologies which are not stable in full equilibrium. This offers interesting possibilities as a method for preparing novel materials.

DY 13.3 Tue 14:45 MA 004

Stochastic data analysis for in-situ damage analysis — •Philip Rinn, Joachim Peinke, Hendrik Heisselmann, and Matthias Wächter — ForWind – Center for Wind Energy Research, Institute of Physics, University of Oldenburg

A new method how to analyze the elastic features of a mechanical structure under turbulent excitation is presented. One limitation of common approaches is that noisy excitation of the structure makes it harder to detect changes reliably, because peaks in the frequency spectrum are broadened due to the noise and changes can not be detected precisely. We use an in-situ approach to look at the dynamical behavior of the system and to analyze damages due to its changing of the systems dynamics. With methods from stochastic data analysis we separate the stochastic part from the deterministic part of the system. In particular the Langevin equation from undamaged and damaged beam structures in turbulent air inflow is reconstructed. We show that the slope of the drift, that is the determinism of the system, changes with increasing damage and compare the results with changes in eigenfrequencies.

DY 13.4 Tue 15:00 MA 004

When it pays off to pay tax: Insights from coupled multiplicative stochastic processes — Jan Lorenz[1,2] and •Frank Schweitzer[1] — [1]Chair of Systems Design, ETH Zurich, Kreuzplatz 5, 8032 Zurich, Switzerland — [2]Center for Social Science Methodolgy, Carl von Ossietzky University Oldenburg, Ammerlander Heerstr. 114 - 118, 26129 Oldenburg, Germany

We demonstrate by mathematical analysis and systematic computer simulations that taxation and redistribution of wealth can lead to sustainable growth of wealth in a society. The wealth dynamics of each agent is described by a stochastic multiplicative process which, in the long run, leads to the destruction of individual wealth and the extinction of the society. When this lossy process is combined with a taxation mechanism, where some proportion of wealth is collected by a government, which further reduces a fraction as costs for administration. The remaining public good is equally redistributed to all agents. We derived conditions for under which the destruction of wealth can be turned into sustainable growth, despite the losses from the random growth process and despite the administrative costs.