AKSOE 8 Poster Session

Zeit: Montag 14:00–15:30 Raum: Poster TU E

AKSOE 8.1 Mo 14:00 Poster TU E

Simulation of Pedestrians with the Social Force Model — •Anders Johansson and Dirk Helbing — Institute for Transport & Economics, Dresden University of Technology

In order to fully understand and analyze how the infrastructure in public facilities as well as in urban regions affects the overall characteristics of pedestrian crowds within these areas, computer simulations need to be performed. An implementation of the Social Force Model is discussed, which is suitable for both small-scale pedestrian simulations as well as computationally fast large-scale pedestrian simulations. We show simulations of proposed design solutions for maximizing the throughput and avoid peaks of density and pressure at critical locations. Among the applications one can find; Pilgrim streams on the Jamarat bridge, evacuation of soccer arenas and theaters. Also, self-organization phenomena such as lane formation, stripe formation and oscillations at bottlenecks are discussed.

AKSOE 8.2 Mo 14:00 Poster TU E

Autonomous Agents Controlling Traffic Lights — •Jürgen Mikat, Elmar Brockfeld, and Peter Wagner — Institute of Transport Research, German Aerospace Center (DLR) in der Helmholtz-Gemeinschaft, 12489 Berlin-Adlershof, Germany

In todays' road networks, traffic management methods are of more and more importance with steadily increasing traffic. Detector values are related to pre-assigned, fixed signal programs or used to adapt the signal phases within a signal phase frame. Drawbacks of these detectors are high installation costs and limitations in data usage. From a single detector information on vehicle speeds or number of vehicles waiting is not available. With the development of information technologies new kinds of detectors allow a more flexible operation of traffic signals by using additional information on traffic flow. This allows in turn the development of concepts of autonomous acting traffic lights reacting on the demand at the intersection or within the approaches. We give examples of autonomous acting traffic lights equipped with simple rule sets optimizing the traffic flow along a road segment and between several neighboured intersections.

AKSOE 8.3 Mo 14:00 Poster TU E

Social and traffic networks in an agent-based freight transport demand model — •Michael Spahn and Peter Wagner — Institute of Transport Research, German Aerospace Center (DLR) in the Helmholtz Association, Rutherfordstrasse 2, 12489 Berlin, Germany

An agent-based, microscopic freight transport demand model is presented. Agents represent producers and consumers of goods in an economy. Through their economic actions demand for freight transport is generated and satisfied via agents representing transport providers. The resulting traffic flow is treated microscopically and allows for a detailed examination of the consequences of policy measures, technical innovations and economic changes for freight transportation.

For a simplified version of this complex model the resulting social networks between firms and traffic networks are presented and characterized.

AKSOE 8.4 Mo 14:00 Poster TU E

Stochastic Description of Traffic Breakdowns — •Jevgenijs Kaupužs[1] and Reinhard Mahnke[2] — [1]Univ. Latvia, LV–1459 Riga, Latvia — [2]Inst. of Physics, Univ. Rostock, D–18051 Rostock

We analyse the characteristic features of jam formation on a circular one-lane road. We have applied an optimal velocity model including stochastic noise, where cars are treated as moving and interacting particles. From the *probabilistic point of view* we investigate a quite classical dynamical system given by stochastic differential equations, i. e. ordinary differential equations with multiplicative noise. Based on this Langevin approach the distributions of vehicular velocity difference as well as headway distances are calculated and discussed.

In analogy to the gas-liquid phase transition in supersaturated vapour at low enough temperatures, we observe three different regimes of traffic flow. There are the free flow regime (like gaseous phase) at small densities of cars, the coexistence of a jam and free flow (like liquid and gas) at intermediate densities, and the homogeneous dense traffic (like liquid phase) at large densities.

[1] J. Kaupužs, H. Weber, J. Hinkel, R. Mahnke, Application to Traffic Breakdown on Highways, In: Progress in Industrial Mathematics at ECMI 2002, Springer, Berlin, pp. 133 – 138, 2004
[2] R. Mahnke, J. Kaupužs, Phys. Rev. E **59**, 117, 1999
[3] P. E. Kloeden, E. Platen, Numerical Solution of Stochastic Differential Equations, Springer, Berlin, 1992

AKSOE 8.5 Mo 14:00 Poster TU E

Stochastic Description of Traffic Breakdowns — •Julia Hinkel[1], Reinhard Mahnke[1], Jevgenijs Kaupužs[2], and Anna Berezovskaya[3] — [1]Inst. of Physics, Univ. Rostock, D–18051 Rostock — [2]Univ. Latvia, LV–1459 Riga, Latvia — [3]Univ. Kiev, UA–01033 Kiev, Ukraine

We analyse the characteristic features of jam formation on a circular one-lane road. We have applied an optimal velocity model including stochastic noise, where cars are treated as moving and interacting particles. From the *probabilistic point of view* we investigate a quite classical dynamical system given by stochastic differential equations, i. e. ordinary differential equations with multiplicative noise. Based on this Langevin approach the distributions of vehicular velocity difference as well as headway distances are calculated and discussed.

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[3] P. E. Kloeden, E. Platen, Numerical Solution of Stochastic Differential Equations, Springer, Berlin, 1992

AKSOE 8.6 Mo 14:00 Poster TU E

Envy: from the economic theory to the computer simulation — •Elena Ramirez-Barrios, Juan G. Diaz-Ochoa, and Johannes J Schneider — Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

The normative meaning and the low measurability make "Fairness" a concept that is very difficult to apply, but occupies a good place in the political decisions as it is e.g. used as an indicator of social welfare. Using Monte Carlo, we simulate with two different models the economical agents' behavior and measure the fairness exploring different concepts from the economical theory, finding a trend behavior such that their improved actions result in a justice horizon as suggested by the first and second welfare theorems. In our models, we consider two different situations in an economy without production: each agent owns an initial allocation of a finite number of commodities. The price system shall avoid that the agents choose a net trade according to their preferences, which is maximal in their budget set. These scenarios should result in an equilibrium under optimal conditions. Fairness follows the fact that all agents have the same trading possibilities and the same access to the entire set of commodities. Also the information flow between the agents and their personal comparisons play a fundamental role.

AKSOE 8.7 Mo 14:00 Poster TU E

Pricing of path-dependend derivatives with truncated Levy-Flights — •Thomas Schwiertz[1] and Wolfgang Paul[2] — [1]Koenigsbergerstr. 2, 65462 Gustavsburg — [2]Institut fuer Physik, Staudingerweg 9, 55099 Mainz

In general, derivatives are priced by the assumption that the return of a price fluctuation is a Gaussian process (e.g. Black-Scholes-Theory: Brownian Motion). It is known that the distribution of price fluctuations on short time scales shows fat-tails. Random walks with truncated Levy-flights can explain price fluctuations on short time scales more accurately. Since payoffs of path-dependend derivatives are often influenced by price fluctuations on short time-scales (e.g. barrier options with a barrier close to the actual price of the underlying or exotic options), we analysed properties of random walks with truncated Levy increments by computer simulations. We discuss extremes, recurrent events and the convergence

to a Gaussian process for these random walks.

AKSOE 8.8 Mo 14:00 Poster TU E

Analysis of the performance of microscopic models of stock markets. — •Roberto Monetti, Wolfram Bunk, Ferdinand Jamitzky, Christoph Raeth, and Gregor Morfill — CIPS, Max-Planck-Institut für extraterrestrische Physik, Giessenbachstr 1, 85748 Garching, Germany

Recently, several microscopic models have been proposed to reproduce certain aspects of the stock markets dynamics. They are motivated by a quest for a possible universal dynamics underlying different markets. Here, we discuss the ability of two recently proposed models (Phys. Rev. Lett. **89**, 158701, 2002; Phys. Rev. E **69**, 046112 2004) to mimic nonlinear properties as expressed by the Fourier Phase Maps. Using the Fourier phases $\{\phi_{\vec{k}}\}$ and a phase shift $\vec{\Delta}$, we represent the phase information on a 2D space via the phase maps $M = \{(\phi_{\vec{k}}, \phi_{\vec{k}+\vec{\Delta}})\}$. The information rendered on this space is analyzed using the spectrum of weighting scaling indices to detect phase coupling at any scale $\vec{\Delta}$. Our analysis reveals that the logarithmic stock returns of the Dow Jones displays a novel characteristic scale of non-linearities. Our method is then used as a "test bed" for model generated time series which should reproduce this property. The results may help to improve microscopic models of the dynamics of the stock market.

AKSOE 8.9 Mo 14:00 Poster TU E

Default probabilities in non-uniformly regulated banking networks — •Klaus Dragosits and Stefan Thurner — Compex Systems Research Group, HNO, Meduniwien, Währinger Gürtel 18-20,A-1090 Wien

The global financial market can be regarded as a pool of local (national) banking networks. Some global rules as the Basle Capital Accord have been established, still any local regulator is free to set stronger rules, and any participating bank may try to disobey the regulations (moral hazard) at least for a limited period of time.

By extending the properties of an established iterative risk-trading game, we investigate interactions between banks which are more or less strongly regulated. Our evaluation criterion is the stability of the resulting networks, which we benchmark by the default probability of the involved banks.

Aside from a profound analysis for various networks with different topologies and different ratios of regulated vs. unregulated banks, focus was put on a realistic real world set-up, where the most wealthy banks are stronger regulated (example is motivated by a recent proposal of Austrian local banks).

As expected, different topology-dependent transitions between totally regulated and totally unregulated networks are obtained. In our wealth-dependent setup we find a phase were the default risk in a non-uniformly regulated network is even higher than in a totally unregulated network, a result we consider of fundamental significance for network regulation.

AKSOE 8.10 Mo 14:00 Poster TU E

Investigation on risk of a CAPM-portfolio — •vladimir reznik und uli willibald spreitzer — Dr. Dr. Heissmann GmbH, Abraham-Lincoln-Str. 22, 65189 Wiesbaden

We investigate a portfolio, consisting of an investment without risk and an investment with a variable rate of return. We use "lower partial moments" to calculate the loss. We investigate the relation between the loss of the portfolio and several parameters, as construction of the portfolio, rate of return of the investment, variance of investment etc.

AKSOE 8.11 Mo 14:00 Poster TU E

Investigation of different index-based portfolios by using the measures: loss, expected rate of return, average loss and possibility of an loss — •Uli willibald spreitzer[1], vladimir reznik[1] und thomas riepl[2] — [1]Dr. Dr. Heissmann GmbH, Abraham-Lincoln-Str. 22, 65189 Wiesbaden — [2]Thomas-Mann-Straße 22, 93077 Bad Abbach

We investigate several portfolios consisting of a save investment and an investment without risk. For the later we use a typical share, which is describen by the characteristic data (rate of return, variance) of several indices (EuroSToxx, MSCTI Europe and DAX 30). We evaluate the different portfolios with respect to the aim of the investor.

AKSOE 8.12 Mo 14:00 Poster TU E

When Fundamentalists Benfit From Chartists — •Roland Rothenstein and Klaus Pawelzik — Universität Bremen, Institut für Theoretische Physik, Otto-Hahn-Allee 1, 28359 Bremen

Agent based stock market models serve to test long standing hypothesis in economics. Here we investigated if agents representing fundamental traders do indeed take advantage from the presence of speculators. We use a paradigmatic stock market model in which the fundamentalists are modeled by stochastic orders whose mean is predictable while agents representing chartists base their orders on predictions of returns. Our simulations reveal that the fundamentalists generally attain a larger mean turnover of stocks and money when a large population of chartists with random prediction parameters participates in trading. Interestingly, the system self-organizes into a stationary state where the remaining price fluctuations are unpredictable and have a power-law distribution such that the mean profit rate for the speculators seem to vanish. Our results confirm that speculative markets can provide an efficient feedback control to a dynamical system from which in the long run only the fundamentalists take advantage.

AKSOE 8.13 Mo 14:00 Poster TU E

Market leader detection with Langevin equation — •Thorsten Schneider, Andreas Nawroth, and Joachim Peinke — Carl-von-Ossietzky-Universität Oldenburg

We present a stochastic analysis of different data sets from the NYSE that consist of all trades from August 2001 to January 2004. The smallest set comprises $7 \cdot 10^5$ quotes. We regard on the one hand the price timeseries and on the other hand the resulting increment timeseries. Directly from these timeseries which are neither continuous nor equidistant the drift and diffusion coefficients of the corresponding Langevin equation are extracted. We use this equation to find out dependencies between different companies for example to determine a market leader and to detect situations where the statistic behavior of an asset changes.

AKSOE 8.14 Mo 14:00 Poster TU E

Wealth distribution of wealth-scattered agents — •Hynek Lavička — Department of Physics, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 7, CZ-11519, Praha 1, Czech Republic

A model describing networked society of interacting particles-agents characterised by single internal variable - wealth, is investigated. Interaction between the agents is like inelastic scattering where overall wealth increases during the interaction. Every agent is associated to a node in the network of possible interactions. Two types of networks will be considered: small-world and scale-free networks. Simulations show the Pareto power-law tail in the wealth distribution. Moreover, correlations between wealth and connectivity and more detailed effects of the netwotk topology are found. Comparison with analytical results is provided.

AKSOE 8.15 Mo 14:00 Poster TU E

Risk Strategies in Random Environments — •Jesus Emeterio Navarro Barrientos — Institut fuer Informatik; Humboldt Universitaet zu Berlin

The performance of agents with different risk strategies in different multiplicative additive stochastic processes is studied. By means of Monte Carlo simulations different probability distributions (some of them power law distributions) for the budget of agents are obtained. We compare some of the results against simpler strategies (small constant risk) and finally we discuss for which cases it pays to use a more complex risk strategy.

AKSOE 8.16 Mo 14:00 Poster TU E

Effects of network topology on strategy distributions in a IPD — •Robert Mach and Frank Schweitzer — D-MTEC, ETH Center, CH-8092 Zurich

Agents are assumed to interact repeatedly in an iterated Prisoner's Dilemma (IPD) game. The agents are endowed with a one-step memory and thus can play one of 8 different strategies. The interaction is locally restricted by a network topology, where each agent represents one node. The agents try to increase their individual payoff by adopting the strategy of their most successful partner at the end of each generation. This adaptation process leads to strategy distribution, that crucially depends on the network topology.

AKSOE 8.17 Mo 14:00 Poster TU E

Similarity-based cooperation and spatial segregation — •Arne Traulsen and Jens Christian Claussen — Theoretical Physics, University Kiel

We analyze a cooperative game, where the cooperative act is not based on the previous behavior of the coplayer, but on the similarity between the players. This system has been studied in a mean-field description recently [1]. Here, the spatial extension to a two-dimensional lattice is studied [2], where each player interacts with eight players in a Moore neighborhood. The system shows a strong segregation independent of parameters. The introduction of a local conversion mechanism towards tolerance allows for four-state cycles and the emergence of spiral waves in the spatial game. In the case of asymmetric costs of cooperation a rich variety of complex behavior is observed depending on both cooperation costs [2]. Finally, we study the stabilization of a cooperative fixed point of a forecast rule in the symmetric game, which corresponds to cooperation across segregation borders. This fixed point becomes unstable for high cooperation costs, but can be stabilized by a linear feedback mechanism [2].

[1] A. Traulsen and H. G. Schuster, Phys. Rev. E **68**, 046129 (2003)
[2] A. Traulsen and J. C. Claussen, Phys. Rev. E **70**, 046128 (2004)

AKSOE 8.18 Mo 14:00 Poster TU E

Nongaussian fluctuations arising from finite populations: Exact results for the evolutionary Moran process — •Jens Christian Claussen and Arne Traulsen — Theoretical Physics, University Kiel

The appropriate description of fluctuations within the framework of evolutionary game theory is a fundamental unsolved problem in the case of finite populations. The Moran process recently introduced into this context [1] defines a promising standard model of evolutionary game theory in finite populations for which analytical results are accessible. Here we derive the stationary distribution of the Moran process population dynamics for arbitrary 2×2 games for the finite size case [2]. We show that a nonvanishing background fitness can be transformed to the vanishing case by rescaling the payoff matrix [2]. In contrast to the common approach to mimic finite-size fluctuations by Gaussian distributed noise, the finite size fluctuations can deviate significantly from a Gaussian distribution [2].

[1] M. A. Nowak, A. Saski, C. Taylor, and D. Fudenberg, Nature 428, 646 (2004).
[2] J. C. Claussen and A. Traulsen, cond-mat/0409656.

AKSOE 8.19 Mo 14:00 Poster TU E

Estimate Memory Effects from Time Series — •Daniel T. Schmitt and Michael Schulz — Department of Theoretical Physics, University of Ulm, D-89069 Ulm

From Mori-Theory we know that any microscopically deterministic dynamics of a complex system can be described by an integro-differential equation, the so called generalized langevin equation.

Our objective is to estimate the memory kernels and frequency terms form artificially generated as well as real world time series. Results can be used to classify the dynamics. Possible applications include forecasting in finance and economics.

AKSOE 8.20 Mo 14:00 Poster TU E

Random Matrix Theory and Robust Covariance Matrix Estimation for Generalized Elliptical Distributions — •Gabriel Frahm[1] and Uwe Jaekel[2] — [1]Center of Advanced European Studies and Research, Financial Engineering, Ludwig-Erhard-Allee 2, 53175 Bonn, Germany — [2]C&C Research Laboratories, NEC Europe Ltd., Rathausallee 10, 53757 Sankt Augustin

The traditional class of elliptical distributions is extended to allow for asymmetries. A completely robust covariance matrix estimator (the "spectral estimator") for the new class of "generalized elliptical distributions" is presented. It is shown that the spectral estimator corresponds to an M-estimator proposed by Tyler (1983) in the context of elliptical distributions. Both the generalization of elliptical distributions and robust covariance matrix estimation are motivated by the stylized facts of empirical finance. Further, some elements of Random Matrix Theory (RMT) are presented. RMT can be used for analyzing high-dimensional stochastical systems. It is shown that the fundamental theorem of RMT (the "Marčenko-Pastur law") fails if the sample covariance matrix is considered as a random matrix in the context of elliptically distributed and heavy tailed data. But substituting the sample covariance matrix by the spectral estimator resolves the problem and the Marčenko-Pastur law remains valid.

AKSOE 8.21 Mo 14:00 Poster TU E

Analyzing systems of connected machines by Hidden Markov Models — •Andre Löser and Günter Radons — TU Chemnitz, Institut für Physik, 09107 Chemnitz

The probabilistic behavior of machines connected by finite buffers is analyzed by fitting Markov processes to the time dependence of the system state. In many practical cases the system behavior is dominated by blocking and starving due to finite buffers connecting (un)reliable machines. This results in a quite complex behavior of the system, which makes it difficult to analyze in practice, especially if the system is large and heterogeneous. Therefore the state space has to be reduced to get a manageable model at least for a specific part of the full system. Because there is no one-to-one correspondence between the real state space and the reduced state space, we use Hidden Markov Models (HMM) for this purpose. The Baum-Welch and a modified Baum-Welch algorithm is used to fit the HMM parameters. It is worth mentioning that an application of our approach to other problems with a complex state space and blocking (starving), such as systems of quantum dots, is possible.

AKSOE 8.22 Mo 14:00 Poster TU E

General models as an approach to socio-economic systems — •Thilo Gross — ICBM, Carl von Ossietzky Universität, 26111 Oldenburg

The central problem of mathematical modelling is to formulate theoretical and experimental insights in the language of mathematics. Because of the complexity of socio-economic systems it can be very difficult to derive explicit mathematical functions that describe them. An alternative is the investigation of general models. In these models the processes are described with general mathematical functions, which are not specified. Despite their generality such models can be analysed efficiently in the framework of local bifurcation theory. In the past this modelling approach has been applied to ecological systems. It has been shown that general models can be used to generalize findings, identify key parameters and to point out degeneracies in specific models.