SOE 18: Traffic Dynamics, Urban and Regional Systems II

Time: Thursday 10:15–11:15 Location: H 0110

SOE 18.1 Thu 10:15 H 0110

Simulation of dynamical information spread during pedestrian evacuation — •Mirko Kämpf[1], Christian Napierala[2], and Jan W. Kantelhardt[1] — [1]Institut für Physik, Martin-Luther Universität Halle-Wittenberg, Halle/Saale, Germany — [2]Fakultät für Maschinenbau, Otto-von-Guericke-Universität, Magdeburg, Germany

The collecting and spreading of up-to-date information is crucial for optimizing the evacuation of pedestrian crowds from buildings or large gatherings. If no global communication system is operative (e.g., during emergency situations), information might be collected automatically by future smart-phones (e.g., by accelerometers) and spread using local ad-hoc communication between them. To simulate and characterize the dynamics of such information spread, we combine an agent-based lattice-gas simulation of the evacuation process with a network analysis approach. The model system is a combination of two coupled networks, one representing the paths in the building and one representing the communication network between the agents smart-phones. We study how fast a change of the systems state is recognized, how fast this information is spread and what quality of information is available at a certain location and at a certain time, depending on several parameters. We also compare our results with well-known epidemic infection models (SIR and SIS) and with previous results of simulations in an unrestricted geometry. Furthermore, we analyze the time evolution of the agents information status to find out if we can detect and avoid interference effects.

SOE 18.2 Thu 10:30 H 0110

Optimizing evacuation flow in simple agent-based models — •Tobias Galla — Complex Systems and Statistical Physics Group, School of Physics and Astronomy, University of Manchester, Manchester M13 9PL, United Kingdom

I will discuss simple cellular automata of pedestrian motion, including stylized models based on exclusion processes, to describe situations in which agents have to choose between several escape routes during an evacuation event. Based on simulations, and where feasible analytical approaches, we compute control strategies, maximising the total current through the system. We also address the effects of agent-to-agent communication in such situations.

SOE 18.3 Thu 10:45 H 0110

Public Transport Networks: Fractal Properties — •Christian von Ferber[1,2], Taras Holovatch[1,3], Yurij Holovatch[4], and Vasyl Palchykov[4] — [1]Applied Mathematics Research Centre, Coventry University, UK — [2]Physikalisches Institut, University Freiburg, Germany — [3]Institut Jean Lamour, Nancy University, France — [4]Institute for Condensed Matter Physics Lviv, NAS Ukraine

Public transport networks (PTNs) are often discussed without reference to their geographical embedding. The question arises if there is any underlying structure or principle characterising the observed behaviour of geographically embedded transport routes. Here, we analyse transport routes with respect to their fractal properties in terms of random walks, self-avoiding walks and Levy flights.

For routes optimizing the time of passenger travel one may expect distance to grow linearly with the path length L. Surprisingly, the empirical data show quite a different behavior. For all means of transport analyzed within this study the dependence of the mean square distance $<R^2>$ on L is well described by a power law with an exponent that is significantly smaller than two. For most transport routes this power law appears to be close to that known for the self-avoiding walk. Furthermore, the analysis of the distribution of station intervals along routes displays a range with power law behaviour. This indicates that the travel along these routes may in part also be described as Levy-flights.

SOE 18.4 Thu 11:00 H 0110

Proximity based city growth — •Diego Rybski, Anselmo García Cantú Ros, and Jürgen P. Kropp — Potsdam Institute for Climate Impact Research, Potsdam, Germany

We propose a simple city model which is based on proximity. The probability that a site is occupied is solely determined by the distance to other occupied sites. We study the cluster size distribution and find power-law probability densities, consistent with real cities. In contrast, the growth is random as expected from the model. Studying the boundary of the largest cluster, we find fractal structures which we relate to the model parameter. We find that this basic approach reproduces various important features of urban structures and conclude that proximity is a dominating aspect of spatial development.