AKSOE 5 Traffic Dynamics, Urban and Regional Systems I

Zeit: Samstag 10:30–12:30 Raum: TU P-N203

AKSOE 5.1 Sa 10:30 TU P-N203

Self-Organized Adaptive Signal Control in a Fluid-Dynamic Traffic Flow Model of Urban Queuing Networks — •Dirk Helbing and Stefan Lämmer — Institute for Transport & Economics, Dresden University of Technology, D-01062 Dresden

We present a fluid-dynamic model for the simulation of urban traffic networks with street sections of different lengths and capacities. The model allows one to efficiently simulate the transitions between free and congested traffic based on an integrated Lighthill-Whitham model. On top of this, we observe non-linear dynamic patterns which are produced by the respective network topology. Synchronization is only one interesting example and implies the emergence of green waves. In this connection, we will discuss adaptive strategies of traffic light control which can considerably improve throughputs and travel times, using self-organization principles based on local interactions between vehicles and traffic lights. Similar adaptive control principles can be applied to other queueing networks such as production systems.

References:

[1] D. Helbing: A section-based queueing-theoretical traffic model for congestion and travel time analysis in networks, *J. Phys. A: Math. Gen.* **36**, L593-L598 (2003).

[2] S. Lämmer, D. Helbing, and J.-P. Lebacque, Self-organized traffic control in urban road networks, preprint (2004).

AKSOE 5.2 Sa 11:00 TU P-N203

Modelling Traffic Flow Fluctuations — •Peter Wagner — Institute of Transport Research, German Aerospace Centre, Rutherfordstrasse 2, 12489 Berlin

The analysis of time headway distributions of traffic flow yield an interesting result: when viewed as a function of speed, the headway distribution undergo a transition from a Poissonian dominated regime (for large speeds) to a power-law regime (for intermediate speeds in the range $10 \leq v \leq 30$ m/s). The power-law distribution can be modelled by a simple stochastic process (stochastic differential equation) that act on the preferred headway of an individual driver.

Additionally, more detailed empirical results will be presented related to the so called slow-to-start mechanism identified for models as one of the major reasons for jam stability.

Finally, the comparison of German and US-American data-sets demonstrates similarities, as well as differences on the level of the time headway distributions.

By inserting this mechanism into microscopic traffic flow models, the models become more realistic in term of their fluctuation structure, which so far has been difficult to model. This is different from the usually fluctuation mechanism used in microscopic modelling, where the noise is acting as additive noise on the acceleration directly.

AKSOE 5.3 Sa 11:30 TU P-N203

Simulating vehicular traffic in a network using dynamic routing — •Florian Siebel and Wolfram Mauser — Department of Earth and Environmental Sciences, University of Munich, Luisenstraße 37, D-80333 Munich

We present a new numerical code which solves the Lighthill-Whitham model, the classic macroscopic model for vehicular traffic flow, in a network with multi-destinations. We use a high-resolution shock-capturing scheme with approximate Riemann solver to solve the partial differential equations of the Lighthill-Whitham-theory. These schemes are very efficient, robust and moreover well adapted to simulations of traffic flows. We develop a theory of dynamic routing including a procedure for traffic flow assignment at junctions which reproduces the correct propagation of irregularities and ensures at the same time conservation of the number of vehicles.

AKSOE 5.4 Sa 12:00 TU P-N203

Collective effects in traffic on bi-directional ant-trails — •Alexander John[1], Andreas Schadschneider[1], Debashish Chowdhury[2], and Katsuhiro Nishinari[3] — [1]Institute for Theoretical Physics, Universitaet zu Koeln, D- 50937 Koeln, Germany — [2]Department of Physics, Indian Institute of Technology, Kanpur 208016, India — [3]Department of Applied Mathematics and Informatics, Ryukoku University, Shiga 520-2194, Japan

Motivated by recent experimental work [Burd et al.], we propose models of single- and bidirectional traffic on ant-trails. Although these models are formulated in the simple language of cellular automata, they capture the main features of the dynamics of ants moving on a trail. Crucial differences like altruism vs. egoism between traffic on ant-trails and human vehicular traffic are discussed. In addition, predictions from both models can be tested experimentally. The main feature of the single-lane model is a non-monotonicity of velocity vs. density. Our bidirectional model shows a constant flux over an intermediate density regime. Many properties of the dynamics can be understood by the formation of clusters and coarsening processes.