AKSOE 17: Traffic Dynamics, Urban, and Regional Systems

Time: Thursday 16:15–18:15 Location: EW 203

AKSOE 17.1 Thu 16:15 EW 203

Complex structure of steady state traffic flow diagram: Theory and data — •Christof Liebe — Universität Rostock, Institut für Physik, 18051 Rostock, Deutschland

Within the american **N**ext **G**eneration **Sim**ulation Program (NGSIM) several vehicular datasets were recorded during the last years. These datasets contain a huge amount of data which leads to a good basis of traffic data analysis.

From the view of a physicist it is always positiv to map the reality to simple models. The optimal velocity model is such a simple one. Basically it is a relaxation to an optimal velocity, which is a sigmoidal function depending on the distance to the car in front.

Nevertheless this simple model leads to interesting phenomena well known from real traffic data like jams (cluster formation). Numerical analysis of a one-lane circular road shows a complex fundamental diagram with hysteresis effect. To compare this diagram with the datasets one has to take the length of a car into account which leads to limitation of the density.

Also comparisons concerning the energy and power of cars will be presented.

AKSOE 17.2 Thu 16:45 EW 203

Traffic Dynamics Prospectives: From Fundamental Diagram to Energy Balance — •Reinhard Mahnke and Christof Liebe — Universität Rostock, Institut für Physik, 18051 Rostock, Deutschland

Application of thermodynamics to driven systems is discussed. As particular examples, simple traffic flow models are considered. On a microscopic level, traffic flow is described by an optimal velocity model in terms of accelerating and decelerating forces. It allows to introduce kinetic, potential, as well as total energy, which is the internal energy of the car system in view of thermodynamics. The latter is not conserved, although it has certain value in any of two possible steady states corresponding either to fixed point or to limit cycle in the space of headways and velocities. The fundamental diagram as steady state flux over density shows hysteresis.

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Road traffic monitoring and management based on magnetic imaging of vehicles — •Haibin Gao[1], Joerg Wolff[1], Michael Weinmann[2], Stefan Voit[2], and Uwe Hartmann[1] — [1]Physics Department, Saarland University, P.O.Box 151150, Saarbruecken,, 66041 Germany — [2]Votronic GmbH, Saarbruecker Str. 8, St. Ingbert, 66386 Germany

Increasing road traffic needs optimized traffic management. Magnetic field detectors can be employed for road traffic monitoring by means of vehicle magnetic imaging. Magnetoresistive sensors utilize the earth magnetic field as a bias field for detecting the presence of ferromagnetic objects i.e., components of a vehicle. The passive method of sensing requires no energy to be emitted, thus minimizing both energy consumption and risk of electromagnetic interference. The compact size of the magnetoresistive sensors allows for versatile placement options.

The detector has three identical channels for the three-dimensional detection with a sensitivity of 1nT/Hz. The influence of temperature is nearly completely cancelled in a range of -40 degree to +85 degree. The signal is sampled and mathematically filtered within the detector. The firmware uses changes of the sum of the (unsigned) magnitudes of the signals.

So far more than a thousand magnetic profiles of passing vehicles have been recorded. The speed is obtained by using two detectors at a lateral distance of one meter. Furthermore, magnetic profiles of different vehicles are investigated for vehicle classification.

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Local Control of Traffic Flows in Networks: Self-Organisation of Phase Synchronised Dynamics — Stefan Lämmer[1], •Reik Donner[1], and Dirk Helbing[2] — [1]TU Dresden, Andreas-Schubert-Str. 23, 01062 Dresden, Germany — [2]ETH Zürich, Universitätstr. 41, 8092 Zürich, Switzerland

The effective control of flows in urban traffic networks is a subject of broad economic interest. During the last years, efforts have been made to develop decentralised control strategies that take only the actual state of present traffic conditions into account. In this contribution, we introduce a permeability model for the local control of conflicting material flows on networks, which incorporates a self-organisation of the flows. The dynamics of our model is studied under different situations, with a special emphasis on the development of a phase synchronised switching behaviour at the nodes of the traffic network. In order to improve the potential applicability of our concept, we discuss how a proper demand anticipation and the definition of a priority function can be used to further optimise the performance of the presented strategy.