Dynamic Traffic Models in Transportation Science – Programme

March 9-15, 2018
Dagstuhl, Germany

Monday:

9:00 – 10:00 **Lightening Talks**
2-Minute Talks

10:00 – 10:30 **Coffee Break**

10:30 – 11:30 **Keynote: DTA and Simulations – Chair: Carolina Osorio**

- Gunnar Flötteröd: *Travel behavior variability and congestion feedback in iterated transport simulations*

Abstract: Most transport micro-simulations rely on stochastic travel behavior models. Their stochasticity may be a meaningful modeling feature given expected (i.e. converged) network conditions. During simulation transients, however, their variability may be amplified by network congestion feedback and lead to convergence problems. Means to control travel behavior variability throughout the simulation process are hence considered.

12:00 – 13:00 **Lunch**

13:00 – 16:30 **Break**

16:30 – 17:45 **3x (20+5)-Minutes – Chair: Alex Skopalik**
Dynamic Packet Routing and Flows

- Laura Vargas-Koch: *Competitive Packet Routing With Edge Priorities*
- Veerle Timmermans: *Oligopolistic Competitive Packet Routing*
- Miriam Schlöter: *Earliest Arrival Transshipments in Networks With Multiple Sinks*

18:00 – **Dinner**

19:30 – 20:00 **4x5-Minutes – Open Problems**

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Tuesday:

9:00 – 10:00 Keynote: Algorithmic Game Theory – Chair: Britta Peis

- Rahul Savani: *(Approximate) Equilibrium Computation for Games*

Abstract: This talk will give an overview of equilibrium computation for games. We will cover different representations of games, exact and approximate solutions concepts, and the important algorithmic approaches and complexity-theoretic results. We will place the material in the context of traffic models where possible, and will mention some related open questions.

10:00 – 10:30 Coffee Break

10:30 – 12:00 3x (20+5)-Minutes Talks – Chair: Martin Hoefer
Coordinating Equilibria

- Cristóbal Guzmán: *Great Tolls: How to Induce Optimal Flows under Strategic Link Operators*
- Anja Huber: *Efficient Black-Box Reductions for Separable Cost Sharing*
- Martin Gairing: *The Price of Stability of Weighted Congestion Games*

12:00 – 13:00 Lunch

14:30 – 16:00 Workgroups

16:15 – 18:00 4x20+5-Minutes – Chair: Nico Stier
Wardrop Equilibria and Traffic Demands

- Max Klimm: *Computing all Wardrop Equilibria parametrized by the Flow Demand*
- Marco Scarsini: *When is selfish routing bad? The price of anarchy in light and heavy traffic*
- Marc Schröder: *Network Congestion Games are Robust to Variable Demand*
- Daniel Schmand: *Selfish Network Creation with Wardrop Followers*

18:00 – Dinner

Wednesday: Joint Kenynotes with Seminar "Scheduling"

9:00 – 10:00 **Joint Keynote Talk – Dynamic Traffic Assignment**
Chair: Roberto Cominetti

- Neil Olver: *Equilibria in the fluid queueing model*

Abstract: I'll discuss the fluid queueing model, introduced by Vickrey in '69. It is probably the simplest model that plausibly captures the notion of time-varying flows. Although the model is quite simple, our current theoretical understanding of equilibrium behaviour in this model is rather limited, and many fundamental questions remain open. I'll survey a few aspects, such as a structural characterization by Koch and Skutella, and quite general existence and uniqueness results by Cominetti, Correa and Larré. In the second part of the talk I'll discuss a recent result (joint work with Roberto Cominetti and Jose Correa) where we resolve one simple-sounding question: do queue lengths remain bounded in the equilibria under natural necessary conditions?

10:00 – 10:30 **Coffee Break**

10:30 – 11:30 **Joint Keynote Talk – Approximation Algorithms**

- Ola Svensson: *A Constant-factor Approximation Algorithm for the Asymmetric Traveling Salesman Problem*

Abstract: We give a constant-factor approximation algorithm for the asymmetric traveling salesman problem. Our approximation guarantee is analyzed with respect to the standard LP relaxation, and thus our result confirms the conjectured constant integrality gap of that relaxation.

Our techniques build upon the constant-factor approximation algorithm for the special case of node-weighted metrics. Specifically, we give a generic reduction to structured instances that resemble but are more general than those arising from node-weighted metrics. For those instances, we then solve Local-Connectivity ATSP, a problem known to be equivalent (in terms of constant-factor approximation) to the asymmetric traveling salesman problem.

This is joint work with Jakub Tarnawski and László Végh.

12:00 – 13:00 **Lunch**

14:00 – 16:00 **Social Event: Hike**

16:00 – 17:00 **Coffee Break**

18:00 – **Dinner**

Thursday:

9:00 – 10:00 **Keynote Talk – Equilibria in Auctions**
Chair: Dave Watling

- Nico Stier-Moses: *Multiplicative Pacing Equilibria in Auction Markets*

Abstract: Budgets play a significant role in real-world sequential auction markets such as those implemented by Internet companies. To maximize the value provided to auction participants, spending is smoothed across auctions so budgets are used for the best opportunities. Motivated by a mechanism used in practice by several companies, this paper considers a smoothing procedure that relies on *pacing multipliers*: on behalf of each bidder, the auction market applies a factor between 0 and 1 that uniformly scales the bids across all auctions. Reinterpreting this process as a game between bidders, we introduce the notion of *pacing equilibrium*, and prove that they are always guaranteed to exist. We demonstrate through examples that a market can have multiple pacing equilibria with large variations in several natural objectives. Although we show that computing either a social-welfare-maximizing or a revenue-maximizing pacing equilibrium is NP-hard, we present a mixed-integer program (MIP) that can be used to find equilibria optimizing several relevant objectives. We use the MIP to provide evidence that: (1) equilibrium multiplicity occurs very rarely across several families of random instances, (2) static MIP solutions can be used to improve the outcomes achieved by a dynamic pacing algorithm with instances based on a real-world auction market, and (3) for our instances, bidders do not have an incentive to misreport bids or budgets provided there are enough participants in the auction.

10:00 – 10:30 **Coffee Break**

10:30 – 12:00 **3x 25-Minutes – Chair: Sebastian Stiller**
Traffic Lights and Intersections

- Chris Tampére: *Intersection modeling and its impact on user equilibrium (algorithms)*
- Theresa Thunig: *Effects of fixed-time vs. traffic-adaptive signal control on the total travel time in the user equilibrium in agent-based transport simulations*
- Martin Strehler: *Queues in the cyclically time-expanded network model*

12:00 – 13:00 **Lunch**

13:00 – 16:30 **Break**

16:30 – 18:00 **2x45-Minutes Talks – Chair: Gunnar Flötteröd**
Industry + Kai

- Heiko Schilling: *TBA*
- Kai Nagel: *Autonomous Driving*

18:00 – **Dinner**

19:30 – 20:00 **Work Group Presentations**
Chair: Ekki Köhler

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Friday:

9:00 – 10:00 **Survey Talk –**
Chair: Chris Tampére

- Carolina Osorio: *Optimization and Simulation*

Abstract: Simulation-based dynamic network models have the potential to provide a detailed (e.g., disaggregate) description of demand and of supply. Nonetheless, unlike analytical models, they are computationally inefficient to evaluate and their use to address transportation optimization problems is a challenge. In this talk we present simulation-based optimization algorithms that enable the direct and efficient use of simulation-based dynamic network models for optimization. The main idea is to embed within the algorithms information from the analytical network models. The latter provide analytical problem-specific structural information, which enables the design of computationally efficient algorithms. We present case studies for high-dimensional intricate (e.g., non-convex) optimization problems, such as OD calibration, congestion pricing and signal control. We present results for large-scale networks, including Berlin, Singapore and Manhattan.

10:00 – 10:30 **Coffee Break**

10:30 - 12:00 **3x 25-Minutes – Chair: Martin Gairing**
Computing Equilibria in Congestion Games

- Umang Bhaskar: *Equilibrium Computation in Atomic Splittable Routing Games with Convex Cost Functions*
- Guido Schäfer: *Computing Efficient Nash Equilibria in Congestion Games*
- Alexander Skopalik: *Simple, distributed, and powerful - improving local search for distributed resource allocation and equilibrium computation*

12:00 – 13:00 **Lunch**