Traffic modelling and control workshop

Organized by NeCS team

1st October 2015, Gipsa-Lab, Seminars' room (B208)
Starting time: 15.00

Speakers:

Markos Papageorgiou (Technical University of Crete)

Per-Olof Gutman (Isreal Institute of Technology)

Pietro Grandinetti (Gipsa-Lab, Necs team).

Carlos Canudas de Wit (Gipsa-Lab, NeCS team)

Abstracts:

Motorway flow optimisation in presence of vehicle automation and communication systems (VACS), M. Papageorgiou.

The presence and exploitation of Vehicle Automation and Communication Systems (VACS) while defining optimal control strategies for motorway traffic flow control is addressed in this presentation. VACS may act both as sensors (providing information on traffic conditions) and as actuators, allowing the application of ramp metering, variable speed limit control, and lane changing control. A Quadratic Programming problem is defined on the basis of a novel first-order traffic flow model for multi-lane motorways. An example is presented in order to illustrate the effectiveness of the proposed optimisation problem.

Optimal Traffic Control Synthesis for an Isolated Signalized Intersection, P. O. Gutman

A continuous dynamical model of a simplified controlled isolated intersection is derived in order to find and analyze an optimal control policy to minimize total delay. An analytical solution of the optimal control problem with constrained signal light control is presented. The optimal synthesis is found for the four principal control constraint cases whereby some results from the nineteen sixties are found to be erroneous. The usage of such a model approach for more complicated scenarios is discussed.

Traffic lights control in large scale networks: optimality vs. complexity, P. Grandinetti

The Cell Transmission Model is the most widely used discrete-time representation of traffic networks. When the network is signalized, the CTM needs to be extended in order to include the traffic lights behavior. Two different CTM's extensions are presented in the talk. Depending on the chosen model, different control synthesis arise: two possible solutions to the traffic lights control problem are discussed. The consequences of the proposed approaches are discussed by means of optimality and complexity.

Distributed Games in Traffic Ramp Metering, C. Canudas de Wit

This lecture includes several aspects of modeling and control of traffic systems. We first review some control proprties of flow conservation models. In particular we underline fundamental properties like downstream/upstream controllability and observability. Then we study the problem of distributed optimal balancing of vehicle density in the freeway traffic which is based on the controllability properties. By using such properties, we identify the subsystems to be controlled by local ramp meters. The optimization problem is then formulated as a non-cooperative Nash game that is solved by decomposing it into a set of two-players hierarchical and competitive games. The process of optimization employs the communication channels matching the switching structure of system interconnectivity. By defining the internal model for the boundary flows, local optimal control problems are efficiently solved and can be generalized to any freeway dimension without jeopardize the computational capabilities of the algorithm. The developed control strategy is tested via microscopic simulators.