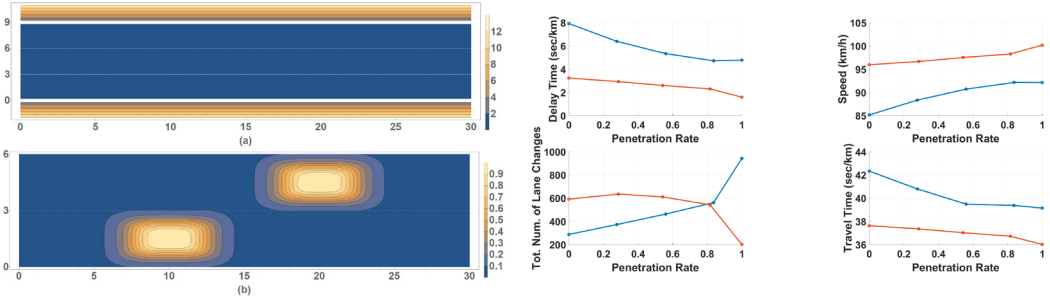
Panagiotis Typaldos
Technical University of Crete

Category: **Road** Country: **Greece**

Research Area 3: **Automation and Robotisation** Idea Number: **26**

Optimization-based path planning for automated vehicles

A path-planning algorithm for automated vehicles on multi-lane motorways is derived by tackling the issue in terms of an optimal control problem. Vehicle dynamics form the state equations of the problem. The road geometry, obstacles (e.g. other moving vehicles and road boundaries) and traffic rules are taken into account with appropriate potential-field-like functions to ensure path feasibility. For the numerical solution of the optimal control problem, an efficient feasible direction algorithm is used. A simplified Dynamic Programming algorithm is implemented to deliver the initial solution. Taking advantage of low computation times, the optimization-based path-planning approach is embedded within a *Model Predictive Control* (MPC) framework, which is implemented in Aimsun micro-simulation platform. Considering a homogeneous motorway stretch and alongside other vehicles following Aimsun's default driving behavior, one or more vehicles are instructed to follow a path produced by the MPC-based optimization approach. The path for each controlled vehicle is generated according to the current lane and speed of surrounding vehicles and is re-generated online in case of substantial changes. Aimsun's micro-simulation platform enables a thorough experimental evaluation of the proposed approach, by considering a large number of different traffic scenarios. In addition, this experimental framework allows the investigation of the impact of the suggested approach not only on the automated vehicles themselves, but also on the traffic flow as a whole for increasing penetration rates of automated vehicles.



Key Characteristics

Path-planning algorithm • Automated vehicles • Multi-lane motorways