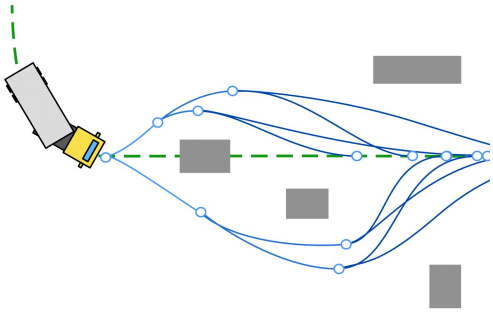
Chair of
Automatic Control

FAU

## Announcement for Bachelor Thesis / Research Project

# Local Graph based Trajectory Planning for Autonomous Vehicles

### Motivation



Autonomous vehicles require a trajectory planning for various maneuvers. If an unknown obstacle is detected during operation the vehicle may be forced to react by deviating from the initially planned route. In the control loop Model Predictive Control (MPC) can deform the trajectories, but hazards the feasibility and solvability of the remaining tracking problem. An approach to solve this is to always enforce the controller to return to the initially planned route. But since this creates a computationally expensive problem another re-planning strategy is desired. Therefore, the aim of this thesis is to investigate the application of a graph based planner for local online re-planning, which considers neighboring obstacles and always assures a return to the initially planned route. This may ensure the solvability of the remaining problem and increases the reliability and safety of the Model Predictive Controller.

### Task description

After a prior literature review, suitable graph-based planners are chosen and investigated. A key factor in the choice of the algorithm is the ability to take vehicle dynamics into account. Subsequently, the local planner is integrated into an MPC controlled loop using the software GRAMPC [1]. The resulting algorithm is evaluated in different scenarios and simulated in a realistic simulation environment.

### Requirements

- First experience in Matlab programming
- The lecture Robotics is beneficial

### References

[1] Englert, T., Völz, A., Mesmer, F., Rhein, S., & Graichen, K. (2019). A software framework for embedded nonlinear model predictive control using a gradient-based augmented Lagrangian approach (GRAMPC). Optimization and Engineering, 20(3), 769-809.

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