

# Novel Control Methods with Safety Guarantees for Dynamical Systems such as Autonomous Cars and Robotic Manipulators



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## Background

Many modern scenarios require autonomous systems to work in human environments and/or to interact with humans. Examples include autonomous driving or robots which collaborate with humans. These application fields can simplify human living and working conditions and increase production efficiency. Safety, however, is crucial in such scenarios. Merely finding efficient controllers for autonomous systems is not sufficient: we also need formal safety guarantees to ensure that the autonomous systems will never harm other traffic participants or human workers.



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### Advisor:

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### Research project:

UnCoVerCPS

### Type:

BA/MA

### Research area:

Control, Automated Vehicles/Robotics

### Programming language:

MATLAB

### Required skills:

Background in control theory and dynamical systems. Experience with Matlab is helpful.

### Language:

German/English

### Date of submission:

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## Description

In order to overcome these problems, we have developed new control algorithms in our group which are able to provide formal safety guarantees *and* achieve very good control performance. This is accomplished by combining different methods from classical control theory with tools from reachability analysis. We can therefore not only guarantee the satisfaction of input and state constraints but also take the effects of disturbances directly into account.

In this thesis, these novel control algorithms should be applied to one of the different application scenarios, e.g., an autonomous car or a robotic manipulator, first on a MATLAB model and after that on a real system, if possible. The tasks are to adapt the control algorithm to the application scenario and to find the optimal parametrization.

If you have background knowledge about control theory and dynamical systems, this thesis provides the opportunity to apply novel control methods to fascinating application fields with the chance of applying them on real systems.

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