



## Einladung zur Fortsetzung des Habilitationsverfahrens von

**Frau Dr.-Ing. Marion Leibold**

**Akademischer Vortrag im Rahmen der Schlussbewertung**

**am Freitag, den 24. Januar 2020, 10.30 Uhr**

Nordgelände, Gebäude N8, 3. OG, Raum N3815

### **“Optimality and Optimal Control in Robot Motion Planning”**

Abstract:

Optimal control is a powerful approach for motion planning of robot systems. In general, it allows to find cost minimising trajectories that additionally consider constraints on actuation, environment or task execution. Challenging is the necessity to perform a large number of computations in limited time although increasing computational power and the most recent numerical algorithms more and more allow to handle also the highly nonlinear and high-dimensional fast dynamics of robotic systems.

In this presentation, first, an optimal control approaches is presented for biped robot balancing. Here a database approach is used that allows to do most of the time-intensive numerical computation offline by optimising a number of motion primitives that are then stored in a database. Later, online, primitives are appropriately selected and combined. The major limitation of the database approach, is that due to the limited number of primitives, there is not a primitive for every possible requirement from the environment. It is shown how primitives from the database can be accordingly adapted.

Second, the application of optimal control in autonomous driving will be discussed. Model predictive control online optimisation schemes are used and we focus in particular on how safety can be guaranteed despite of uncertainty in the environment. In a first approach, it is presented how legible motion can be produced by modification of the cost function, that allows other traffic participants to do an early and reliable prediction of the controlled cars behavior. A second approach then allows to produce safe trajectories in uncertain environments by minimisation of the probability that safety critical constraints are violated.

Der Vortrag ist **hochschulöffentlich**.

Dekan Prof. Dr.-Ing. Wolfgang Utschick

München, den 9. Januar 2020

Verteiler:

Fachmentorat, Präsident der TUM, Dekane der TUM, Fakultätsrat, Professorenkollegium