

PhD Thesis/ Dissertation



Digital-twin based virtual validation of an electric autonomous bus including collaborative perception

In a bilateral research project with China, involving Tongji University, Wenzhou University along with Austrian and Chinese industry partners, a hardware demonstration of an electric autonomous shuttle bus involving collaborative perception will be developed. In the project TU Graz will contribute to **develop and validate automated vehicle control**.

In the state-of-the-art, traditional on-road testing is not sufficient for demonstrating safety and comfort for a driverless vehicle. Hence, virtual validation is a necessary part of vehicle development. The simulation will implement different research achievements of the different partners in a complex simulation environment.

Contents of PhD thesis:

- Detailed **3D Modeling** of the driving environment and environmental conditions of the selected test sites.
- Modeling of the **dynamic objects** representing the vehicles, based on the traffic flow simulation from partners
- Detailed modeling of the **ego-vehicle dynamics** of the bus. Focus is given on the modeling of the **drive-train** with the electric components. The battery size is an important design parameter and the maximum range will be considered within the tactical planning of the vehicle route.
- Integration of the **collaborative perception** based on input from partners
- Modeling of the **vehicle guidance** algorithms. Here the theoretical work from the Chinese Universities is transferred to a vehicle control algorithm running in the virtual simulation environment
- Integration of **bus performance evaluation** by metrics related to safety, comfort and efficiency.
- Optimization of parameters in the mission and trajectory planning module to achieve an optimum w.r.t to safety, comfort and efficiency.

Requirements:

- Master in Mechanical, Electrical/Electronic Engineering or Informatics
- Expertise in control theory, parameter identification and multi-body simulation is welcome
- Expertise in machine and deep learning is welcome
- Excellent Programming skills

Duration: 3 years
Start: 1.1.2023
Location: FTG

80% employment contract at TU Graz (32hours per week)

Contact: Assoc.-Prof. Dr. Arno Eichberger, arno.eichberger@tugraz.at