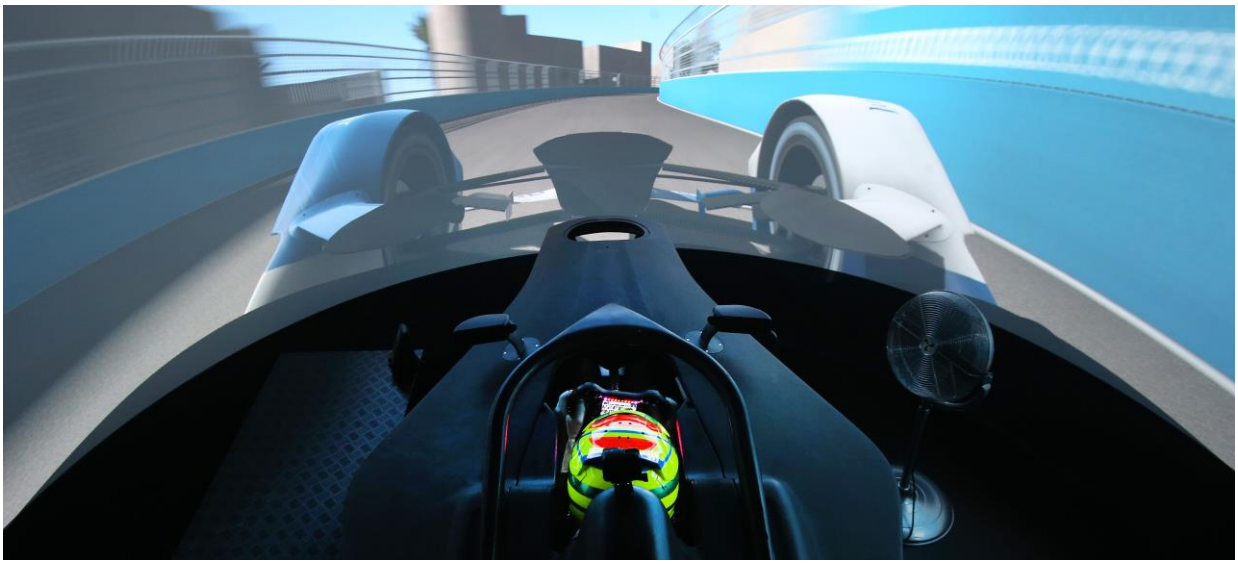
BMW i Motorsport

Master Thesis: Model Predictive Algorithms for Motion Control of a Motorsport Driving Simulator



Institution:	**TU Graz, Institute of Automotive Engineering**
Location:	**Graz (AUT), Munich (GER)**
Industry Partner:	**BMW Motorsport**

Driving Simulation is motivated by various aspects such as cost reduction and safety considerations. In the motorsport environment, engineers and drivers mostly benefit from driving simulators as a tool for training, preparation and vehicle development purposes. Most modern driving simulators are based on a motion platform. Their aim is to provide cues which increase the immersion of the driver. In order to do so, an algorithm is calculating the platform's motion trajectory depending on the vehicle motion. This algorithm is called "Motion Cueing Algorithm" (MCA). The algorithm's design is subject to a variety of constraints and objectives which can be induced by human factors and motion platform limitations. One approach of coping with this challenge is based on Model Predictive Control (MPC).

This work will cover fundamental research on MPC based MCAs. The aim is to define a set of requirements for distinct areas of the MPC design such as prediction horizon length, reference prediction quality or control loop time. Additionally, computational cost for real time implementation should be taken into account. For this purpose, key performance indicators should be identified and evaluated based on simulations. The derived requirements serve as a scientific basis for the design of the real-time executable MCA. For this and for the scientific process, professional exchange on a regular basis with the research and development team is an essential part. Ideally, the thesis is completed by validating the results with an experiment at the driving simulator.

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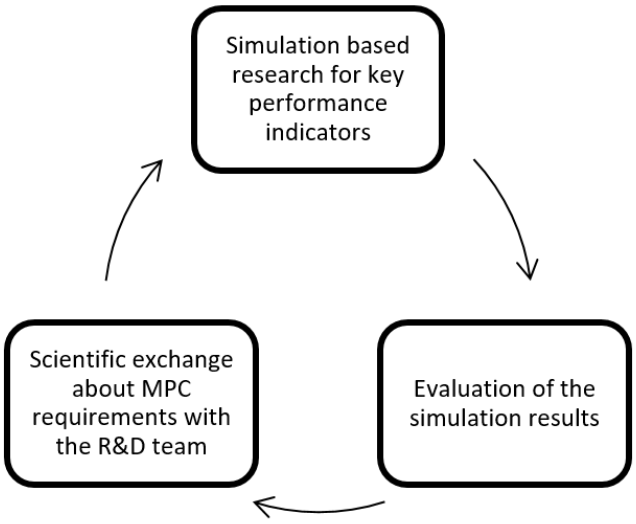
Project phases:

- Literature research focusing on driving simulation, motion cueing and model predictive control
- Familiarization with the Driving Simulator and its software components
- Design and implementation of a suitable simulation architecture and test scenarios
- Research process (see Fig.)
- Interpretation and documentation



Prerequisites:

- Studies in the field of control systems, mechatronics or comparable
- Control theory: basic knowledge
- Programming skills in Matlab / Simulink desirable

The duration of the thesis project will be six months.

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