

Bachelor's / Master's Thesis

Mechanical Design and Prototype Development of a Semi-Active Damper System for a Formula Student Car

Motivation

Formula Student is a global engineering competition where university students design, build and race small formula-style cars. Teams must balance performance, efficiency, reliability and innovation within a limited budget and timeframe. To maximize mechanical grip and vehicle dynamics, semi-active suspension systems offer a massive competitive advantage. While a previous thesis successfully investigated Magneto-Rheological (MR) dampers through simulations and testing of off-the-shelf components, this project focuses on the ground-up development of a custom semi-active damper. The goal is to develop either an MR or an electro-hydraulic damper specifically tailored to our vehicle's extreme packaging and lightweight requirements. A major focus of this work lies in the mechanical design, the coordination with industry sponsors for manufacturing, and the realization of a first functional prototype.

Research Questions

- How can a custom semi-active damper (MR or electro-hydraulic) be mechanically designed to meet the strict weight, packaging, and dynamic response requirements of a Formula Student race car?
- Which manufacturing and integration strategies are most effective when working with industry partners to produce a reliable, high-performance prototype?

Tasks

- Concept evaluation and selection between an MR or an electro-hydraulic damper system based on the vehicle's dynamic requirements.
- Mechanical CAD design and structural analysis (FEM) of the custom damper components.
- Close communication and coordination with industry sponsors to facilitate the manufacturing of the components.
- Assembly and functional validation (testing) of the first prototype on a damper dynamometer.
- Optional: Development of the control engineering strategy (depending on the scope of the thesis, this can also be handled as a separate internal work package).

Further Information

- In cooperation with the TUG Racing Team
- Start: As soon as possible (according to agreement with the TUG Racing Team)

Contact

Kilian Abbrederis

TU Graz Racing Team
Graz University of Technology
Inffeldgasse 25, A-8010 Graz, Austria
Tel: +43 67761446388
E-mail: kilian.abbrederis@racing.tugraz.at
www.tugracing.at