



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

UNC Charlotte – Lee College of Engineering Senior Design Program Company Information

Company Name	<i>Schaeffler</i>	Date Submitted	<i>05/28/2021</i>
Project Title	<i>Active suspension driver seat – Phase 2 (SG_SEAT2)</i>	Planned Starting Semester	Fall 2021

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	2	Electrical	2
Computer	2	Systems	
Other ()			

Company and Project Overview:

Schaeffler’s engineers are working on a range of different technologies designed to make cars cleaner and improve fuel economy. Whether the drive train concept is based on an internal combustion engine, a hybrid or all-electric design, the mix will play an important role in tomorrow’s global mobility. As a partner to the automotive industry, we are leaders in the development and production of system solutions to the critical challenges facing automotive engineering in the future. Close relationships with our customers worldwide and collaborative development work are hallmarks of Schaeffler. Using innovative ideas, creative engineering and comprehensive manufacturing expertise, we provide solutions that begin at the product-development phase and continue through to volume production.

Active, passive and semi-active suspension systems are employed in some vehicle seats to alleviate the harmful and damaging effects due to the transmitted vibration to the human body. In order to improve riding comfort, the operator’s body displacement and acceleration must be reduced. According to the research, active suspension control systems are the best choice to reduce the transmitted vibration to the drivers’ body and provide the best ride comfort in comparison with passive and semi-active systems.

A brief overview of some types of seat suspensions can be found at <https://www.mdpi.com/2076-3417/9/14/2834/pdf>

Project Requirements:

This project will build on the work done by the Phase 1 team (SG_SEAT) of UNC Charlotte students who acquired and modified a tractor seat with a linear actuator. The hardware from phase 1 should be used to test suspension control algorithms and to provide guidance regarding which parts of the mechanism to keep and which should be redesigned.

This project will research, design, and build a prototype of an active suspension vehicle seat utilizing available Schaeffler mechatronic actuation technologies (ie. Linear slide, ball screw, etc). The seat will include sensors for measuring acceleration and orientation, and an algorithm will be developed to adjust the seat to maintain a desired position to counteract input vibrations and loads.

For example, if the vehicle is cornering and imparting a roll moment on the driver, the seat will adjust to counter-lean so as to lower the driver center of gravity and reduce the side loads on the driver. Or if the vehicle is traveling over a rough road, the seat will actively absorb the harsh vibrations before they are transmitted to the driver.

Detailed requirements will be developed together with Schaeffler engineers. Schaeffler will supply available actuation components at no charge to the project team and will support with some machine shop work free of charge.

Expected Deliverables/Results:

- Research of literature on active seat technologies
- Design of active seat utilizing Schaeffler mechatronic actuation technologies
- Develop code for analyzing sensor signals and deciding on needed seat adjustments
- Build and test prototype seat

Disposition of Deliverables at the End of the Project:

All prototypes and modifications to vehicles shall be turned over to Schaeffler at the completion of the project along with CAD models, drawings, and calculations used during design and construction.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- CAD modeling and 3D printing will be required
- Design of kinematic systems is required
- Knowledge of controls software will be needed
- Ability to design and safely install power electronics is needed
- Instrumentation knowledge for data acquisition is needed
- Hands on experience working on cars will be helpful
- Ability to travel to Schaeffler's Ft. Mill, SC facility as required.