

MASTER

## Improved Control and Complexity Reduction of an Electro-Hydraulic Trailer Steering System

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Department of Mechanical Engineering  
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# Improved Control and Complexity Reduction of an Electro-Hydraulic Trailer Steering System

Graduation Report

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CONFIDENTIAL

*This report was made in accordance with the TU/e Code of Scientific Conduct for the  
Master thesis*

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# Abstract

Tridec has developed an electro-hydraulic steering system for trailers, called EF-S. This thesis presents an improved controller for the EF-S system and investigates potential simplifications for the trailer steering system.

A new piston position control strategy for the EF-S trailer steering system has been developed and it is evaluated in simulation, as well as on the test bench. The proposed control strategy generates a feedforward signal based on the knowledge of the flow required for actuation of the hydraulic cylinders. This feedforward signal is combined with a PI controller to improve the system's performance. Furthermore, a control strategy depending on the trailer's load has been investigated. This allows to save energy by reducing the pressure in the steering accumulators when the trailer is not fully loaded.

The thesis also investigates a path-following approach based on the virtual rigid axle command steering (VRACS) approach. The principle of this approach is to use the command steering strategy and apply a delay in the steering actuation of the semitrailer axles.

A complexity reduction of the system is explored by investigating simplifications of the plant model of the control scheme and investigates a reduction of the number of components. Specifically, replacing the block for the actuation of Extra Functions with a simple valve and removing the steering accumulators are considered.

Simulations with a MATLAB/Simulink model of the EF-S system and a multibody model for a tractor semitrailer combination are conducted to validate the feasibility of the proposed simplified system and new control strategies.