Hydraulic valves control of steering axles for converter dolly

Background
Volvo Group is conducting a project called Duo2. An “active converter dolly” project, to support Duo2, is ongoing with collaboration Volvo Group Trucks Technology, Parator AB, SAFER, and Chalmers University of Technology. Goal of this project is to build up an actively controlled converter dolly for an A-double combination. The dolly should have axles with individual steering and braking capabilities.

Problem motivating the project
A converter dolly with two axles with individual steering and braking is currently located at the vehicle dynamics lab of Chalmers Johanneberg Campus. Current ECU from VSE is originally for low vehicle speed steering cases. The ECU has dead-band of two degree and higher time delay including transport delay of about 0.35 seconds. Hence, for high vehicle speed steering cases, the dead-band needs to be removed and the time delay must be minimized to an acceptable limit.

Envisioned solution
Development of a low level control platform capable of sending steering axle hydraulic actuator valve requests. Steering angle request from the high level control needs to be implemented via dSPACE Micro AutoBox to the actuator request so that the high level control request is implemented. The angle sensor values need to read by AutoBox. A safety systems will also work as supervisory system that will prevent over actuation situation.

Objective (or Research Question)
- Establish interface and closed-loop control of requested steering angles of the two axles so that the dSPACE Micro AutoBox can directly send request to the valve of the actuators.
- Time delay will be minimized to an acceptable limit.
- Remove steering dead-band.
- Safety systems for the test-rack driving.
Deliverables
- A thesis report
- Verification with hardware-in-the-loop
- Demonstration with A-double combination vehicle on test track around summer 2016 (depending on the “active converter dolly” project time plan)
- All coding and soft files
- Tutorial documents (maybe video version)
- Handover sessions

Limitations
- Not on public roads

Recommended qualifications
- Interested in combined practical and theoretical tasks.
- Good knowledge on Matlab/Simulink, Mechatronics, Hydraulics, Communication such as CAN and Pulse Width Modulation.
- The two students’ qualifications can be complimentary, such as one from Mechatronics and the other from Hydraulics/Mechanical background.

Administrative
- Number of points: 30 points (nominally 20 weeks)
- Starting date: 1st quarter 2016
- Suitable number of students: 2
- Responsible subject/research group at Chalmers: Vehicle Dynamics
- Examiner: Mohammad Manjurul Islam, manjurul.islam@chalmers.se, 070-789-1800.
- Supervisors:
  o Academic, @Chalmers: Bengt Jacobson, bengt.jacobson@chalmers.se
  o Other: Volvo Group Trucks Technology, Leo Laine, leo.laine@volvo.com, Johan Eklöv, johan.eklov@volvo.com
- Physical locations:
  o Chalmers, VEAS Division, AM Department
  o Chalmers, ReVeRe Test Vehicle Workshop at Lindholmen
References:
