

# Automotive Engineering

## 1. Testing Facilities (Components)



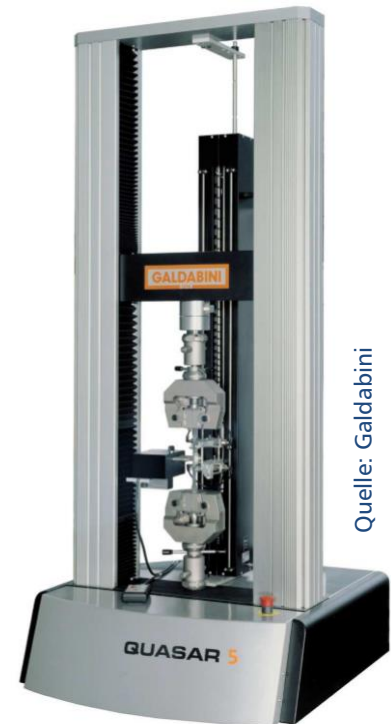
### Friction Test System for Shock Absorbers

#### Galdabini Quasar 5

Machine for tensile and compression tests for the material characterization of elastomers, which has been specially developed for friction measurements in automotive shock absorbers.

#### Specifications:

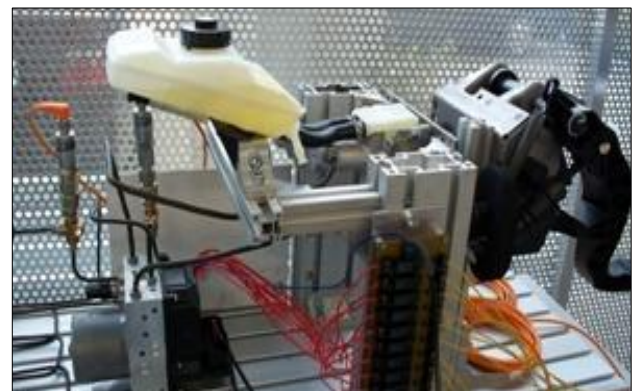
- Standard measuring equipment: force sensor + extensometer
- Additional force, pressure and differential pressure sensors Additional attachments for introducing lateral forces into the damper



### Hardware-in-the-Loop Test Stand

Test stand for the investigation of algorithms developed for anti blocking systems (ABS), electronic stability programs (ESP) and other driving safety systems.

- Hardware: Main brake cylinder, four Wheel brakes, hydraulic control
- Hydraulic control unit (HCU) follows control strategies implemented in MATLAB / Simulink using a dSpace interface



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### Dynamic driving simulator

#### Simulator mock-up

Mock-up for the investigation of user acceptance of different assistance systems and human-technology interactions (MTI or HMI).

Set-up:

- Environmental visualization via 98" 4K screen
- active steering wheel (*Sensodrive*)
- Pedals (throttle, brake) / active pedals are planned

Function:

- Realization of a detailed vehicle simulation with different software tools (IPG CarMaker / PreScan / AMESim)
- CAN communication enables direct influence on steering wheel characteristics in the form of stiffness, damping and friction
- Hardware communication (dSpace / National Instruments): real-time transmission of steering angle and torque to the simulation environment
- feedback active adjustment of the steering wheel



### Hexapod motion system

Extension of the simulator mock-up by an electrical hexapod motion system for realistic vehicle dynamics simulation dynamic feedback.

Field of research:

- Development of novel vehicle dynamics control and driver assistance systems
- Acceptance studies of new driving systems
- Complex and realistic mixed traffic simulations
- Cooperative driving with "human-in-the-loop"



Specification, motion system:

direction	amplitude		speed	acceleration
longitudinal	-0,499 m	+0,628 m	+/- 0,79 m/s	+/- 7,00 m/s <sup>2</sup>
lateral	-0,506 m	+0,506 m	+/- 0,81 m/s	+/- 7,00 m/s <sup>2</sup>
vertical	-0,383 m	+0,372 m	+/- 0,55 m/s	+/- 10,00 m/s <sup>2</sup>
roll	-24,01 deg	+24,01 deg	+/- 34,3 deg/s	+/- 250 deg/s <sup>2</sup>
pitch	-25,05 deg	+28,02 deg	+/- 37,4 deg/s	+/- 250 deg/s <sup>2</sup>
yaw	-27,25 deg	+27,25 deg	+/- 41,3 deg/s	+/- 500 deg/s <sup>2</sup>



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### Vibration Testing System

**TIRA TV 50350-120**

Examination of component vibrations and durability

**Specifications:**

- Rated Power: Sine: 2700 N; Shock: 4000 N
- Swing path max. 25.4 mm
- Sample weight up to 25 kg



### Climate Test Chamber

**FEUTRON 3636/17**

Climatic examination of components

**Specifications:**

- Chamber volume 600l
- (770x1020x745) mm
- Sample weight 3x30 kg
- Temperature range (-75 ... 180) °C
- Humidity range (10 ... 95)%
- Change speed  $\pm$  5K



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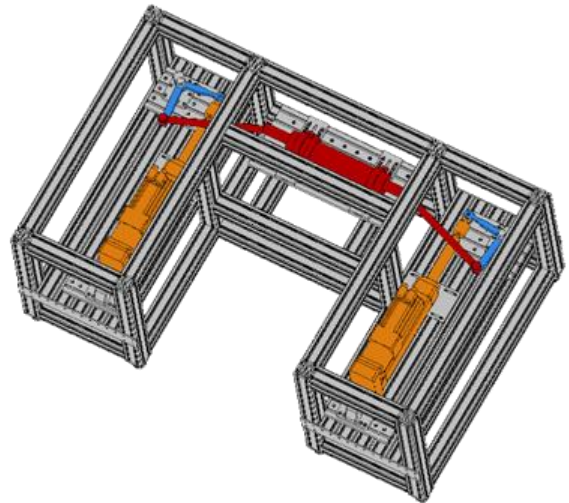
### Steering System Test Bed

#### Research

- Static and dynamic load scenarios for power steering and actuation systems
- Power and efficiency measurements

#### Technical Features

- Electro-mechanical actuators with max. 17,8 kN
- 300 mm of way at up to 267 mm/s
- Constructive realization of steering kinematic
- Max. incidence angle: ca. 30 deg
- Track widths and track lever lengths covering all classes of vehicles (small cars up to SUV)



### Windtunnel Test Bed

#### Research

- Validation of turbulence-, and particle models (CFD)
- Visualisation and measurement of particle dispersion (non exhaust emissions)
- Analysis of particle deposition mechanisms

#### Specification

- Max. volume flow: 7400 m<sup>3</sup>/h equals 5 m/s inside the plenum
- Eclectic Engine: P<sub>max</sub> 135 kW / M<sub>max</sub> 1740 Nm / n<sub>max</sub> 2600 1/min
- Solid and fluid seeding

