Research Project MEHREN
Potentials of Highly-Integrated Wheel Hub Drives for New Vehicle Concepts

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Agenda

- Motivation
- Wheel Hub Drive
- Technology Demonstrator
- Vehicle Concept
- Outlook
Motivation
Urbanization Is Challenging Tomorrow’s Mobility

By 2030, an additional 1.4 bn. people will be living in metropolitan regions.

Wheel Hub Drive
Will It Work?

Unsprung mass
Impact load
Environmental conditions
Wheel Hub Drive
Current E-Wheel Drive Design

- Power electronics and controller
- Stator plate with friction brake and wheel bearing
- Rotor
- Stator with cooling
- Wheel rim (16") with tyre

**Torque:**
350Nm / 700Nm (continuous / peak)

**Performance:**
33kW / 40 kW (continuous / peak)

**Voltage:**
360...420V

**Additional mass:** 45kg
Technology Demonstrator
Joint Ford/Schaeffler Development Project

Targets:
- Component testing of E-Wheel Drive
- Implementation of basic driving strategy
  (longitudinal dynamics, torque vectoring, wheel slip control)
- Attribute testing: steering, handling, ride, performance, NVH
- Functional safety relevant investigations

Technology Demonstrator
Vehicle Configuration

Base vehicle:
Ford Fiesta

Rapid prototyping controller

E-Wheel Drives
(two on rear axle)

12V battery

Power distribution unit

Lithium-ion battery
(16.2kWh, air cooled)

Charger

DC/DC converter

Max. speed: 130km/h
Acceleration:
0-100 km/h 9.8s
60-120 km/h 8.0s
Curb weight: 1,290kg
Technology Demonstrator
Main Findings

- Good driving performance in all tested drive cycles; series performance requirements not yet fully met
- Drive cycle braking possible with regenerative braking only; integration of friction brake insufficient (thermal behaviour)
- Unsprung masses not critical for driving safety and comfort within relevant speed range
- Mechanical robustness of the E-Wheel Drive demonstrated
- Drive noise emissions and transfer into body too high

Vehicle Concept
Motivation

Excitement through new functions and differentiation

Customer Satisfaction

Technical Properties

Notable improvement of technical properties

Electric vehicles (today)
Thank You for Your Attention

- Space-efficient vehicle concept
- Motion Control
- Highly-integrated wheel hub drive
- Regenerative braking system
- Functional safety
- Improved manoeuvrability