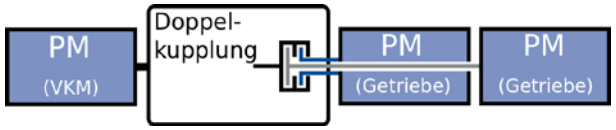
Modularity

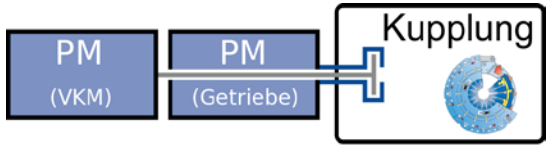
The test bench offers a very high degree of modularity, allowing a large number of arrangements of motors and test specimens. Below you will find three examples.

- Double clutch validation



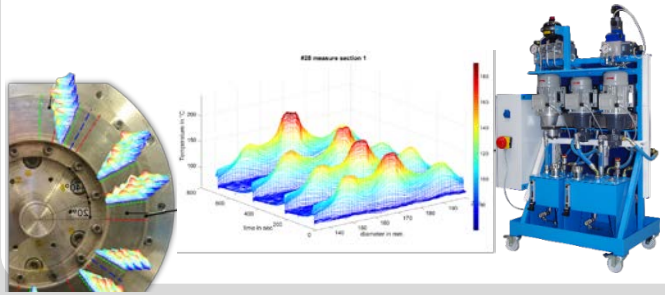
- Dual clutch transmission validation

- Single disc clutch validation



Instrumentation and Actuation

- 3D geometry measurement with 3D Scanning Vibrometer
- High-resolution temperature measurement using fiber optic measurement technology
- Highly dynamic hydraulic unit for setting and controlling hydraulic circuits in test specimens



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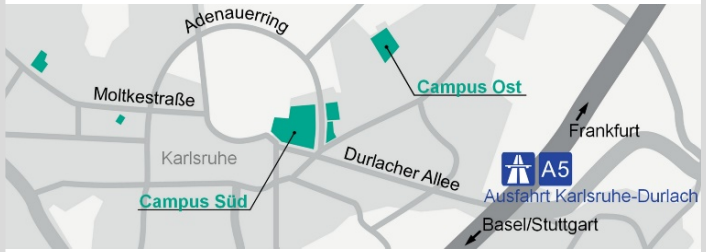

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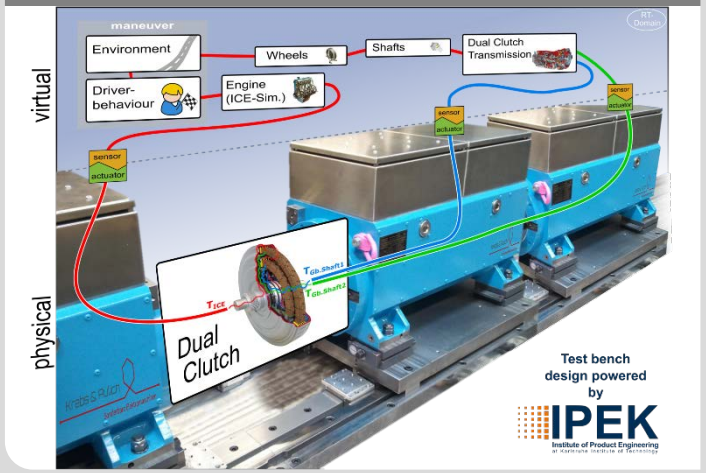
MCP

Multi Component Test Bench

IPEK ▪ Institute of Product Engineering



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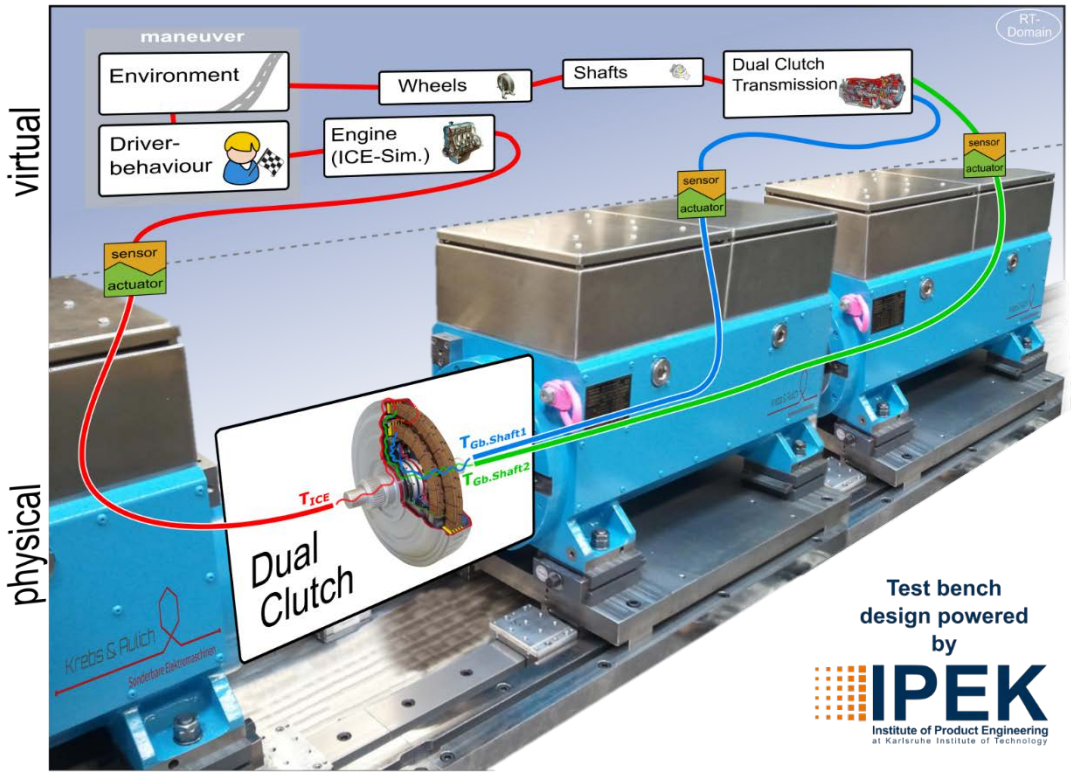
Techni cal specifications

High Dynamic Motors

- Power: 3 x 367 kW
- nom. speed: 5.000 min^{-1}
- max. speed: 10.000 min^{-1}
- torque: 700 / 1.200 Nm
- torque excitation up to 500 Hz
- Rotor inertia: 0,175 kgm^2
- Hollow shaft design / Tandem operation

EtherCAT® Fieldbus

- Real-time Ethernet
- Cycle time: 1/8000 s
- Flexible EtherCAT® topology
- Wide range of I/O components
- EtherLab® Master



Visualization of the IPEK XiL-framework with transition from physical to virtual subsystem using a dual clutch as an example

Real-Time Environment

- Jäger ADwin-Pro II: Powertrainsimulation, digital signal processing up to 50 kHz
- Test bench control using flexible MATLAB®/Simulink®-Models
- Automatic mode, e.g. endurance run
- Analog und digital I/O interfaces
- FPGA programming

Key Specifications

- Modular motor concept - short set-up time for conversion of the test assembly
- Topology variability: coaxial motor arrangement, parallel motor arrangement, and much more.
- Hollow shaft design of highly dynamic motors for modern validation methods (see exemplary investigations)
- Motor coupling for double power output (tandem operation)
- Simple integration of sensors

Investigation examples

Dual Clutch-in-the-Loop

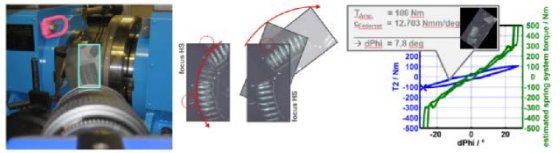
Investigation of the overlapping phases of dual-clutch systems under conditions similar to those of the real system, e.g. by mapping the combustion engine rotational uniformity or the downstream drive train interaction (Fig. left).

Gearbox-in-the-Loop

Analysis of the overall driveline dynamics using individual physical components with virtually available residual driveline to determine judder and shuffle sensitivity.

Subsystem-in-the-Loop

Optical investigation of the spring behaviour of vibration isolators under near operational interactions through improved one-sided accessibility in twin-engine operation.



WorkingSurfacePair-in-the-Loop

Investigation of the oil flow in wet clutch systems using particle image velocimetry under highly dynamic system excitation.