



Fraunhofer

LBF

**FRAUNHOFER INSTITUTE FOR STRUCTURAL
DURABILITY AND SYSTEM RELIABILITY**

FLEXIBLE TESTING

Laboratories and Testing Facilities





INNOVATIVE

FLEXIBLE TESTING

The Fraunhofer Institute for Structural Durability and System Reliability LBF offers comprehensive solutions for the development and qualification of innovative structures and components. This increasingly involves the combination of experimental and numerical simulation. With our expertise, huge variety of test systems and modular equipment, we are able to respond to your specific testing requirements with speed and flexibility.

We cooperate if necessary with regional high qualified partners in a straightforward and professional way. Fraunhofer LBF provides result-oriented and highly efficient solutions with highest quality standards to assist you in your product development activities: Innovative for sure.

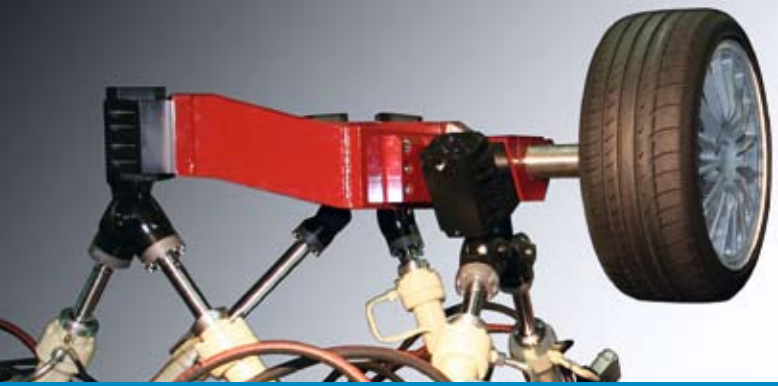


FOR SURE.

SYSTEMS FOR EXPERIMENTAL SIMULATION

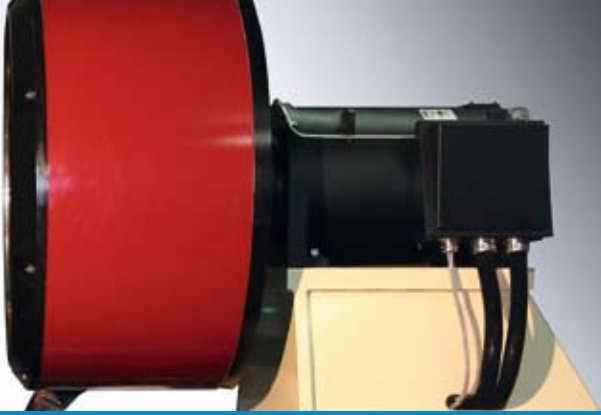
Variable Test Set-ups:

- Servo hydraulic test systems with load capacities ranging from 5 to 2500 kN and torques up to 64 kNm (more than 200 hydraulic test actuators, 330 load sensors, strain transducers)
- Various electrodynamic vibration exciters (shakers) for loads ranging from 20 N to 27 kN (Random Vector Force) and a frequency range up to 15 kHz
- Pressurization systems up to 750 bar
- Development of new drive systems for special mechanical test rigs
- Integration of combustion engines in test rigs
- Test Rig design, design and manufacturing of specimen and clamping devices according to customer requirements



Stationary Test Set-ups:

- 8 biaxial wheel/hub test rigs for passenger cars, commercial vehicles, special-purpose vehicles and motorcycles, including simulation of braking and driving conditions
- Wheel accelerated life testing facility W/ALT
- 25-channel full vehicle test rig for passenger cars, vans, trucks or hybrid and electric vehicles
- 12-channel axle test rigs for durability studies on complex passenger car and commercial vehicle axle systems
- 3-channel test rig for trailer coupling
- Test rig for adaptive structures in vehicle construction
- Gearbox test rig for power train components (drive shafts, joints, clutches and complete gearboxes), nominal torque max. 2000 Nm, speed max. 7500 rpm
- Bearing test rig for testing passenger car wheel bearings under realistic conditions in the original subassembly
- Triaxial test rig for testing passenger car towing devices
- Test rig for testing railway wheel sets
- Servo hydraulic column-type test machines with load capacities from 5 to 2500 kN
- Resonance test machines for test loads from 20 to 600 kN



- Dynamic test machines for small loads from 1 N
- 3 tension/torsion test rigs
- 2 elastomer test rigs (1- and 3-channel)
- Drop weight tester with up to 11 000 J energy input
- Impact tester 2 to 800 J, e. g. for fibre composites
- Static tensile pressure control up to 200 kN, e. g. Compression after Impact (CAI)
- Test rig for the simulation of engine mounts' performance
- Test rig for the characterization of piezo actuators



INNOVATIVE

Measuring Systems:

- Acquisition of physical variables, telemetry systems for logging data on rotating systems, high frequency analysis
- Data logging systems for long term studies on customer vehicles, with data acquisition by modem
- Thermal imaging camera, e.g. thermal stress analyse (TSA) or lock-in thermography
- 3D image correlation system (optical strain and displacement measurement) up to 400 Hz
- Development of sensor systems adapted specifically to the customer's measuring requirements
- LBF®.R-Wheelos rail wheel load sensor for determination of multi-axial loads
- Rotation test rig for vehicle wheels
- Rapid control prototyping systems (development environment for control algorithms and signal processing)
- 4 vehicle/light truck measuring wheels, adaptable to different rim sizes and wheel loads
- 4 truck measuring wheels with vertical and longitudinal forces up to 200 kN, lateral load up to 100 kN, adaptable to different vehicle types and configurations.



FOR SURE.

- Acoustic Emission System for detection of damage in structures
- Dye penetrant testing for crack detection
- Fibre-optic strain measurement with splicing unit and several interrogators
- Handheld ultrasonic test system with different frequency ranges for metal or composite structures
- Optically strain control for S/N curves of polymer material
- Computer tomography and x-ray laminography e. g. composite panels



Structural Vibrations and Acoustics:

- Semi-anechoic measuring environment
- Sound level meter, measurement microphones, 2 microphone arrays
- More than 50 accelerometer, most of them triaxial
- Impact hammers, electrodynamic shakers
- Scanning vibrometer (three-dimensional and contact less measurement of vibrations)
- 40- and 64-channel system for the acquisition and the analysis of sound and vibration
- Experimental Modal Analysis (LMS CADA-X and LMS Test.Lab)
- Sound source localization using steady-state and transient acoustic holography
- Analysis of Operation Deflection Shapes
- Operational Modal Analysis
- Visualization of movement and deformation using high speed cameras

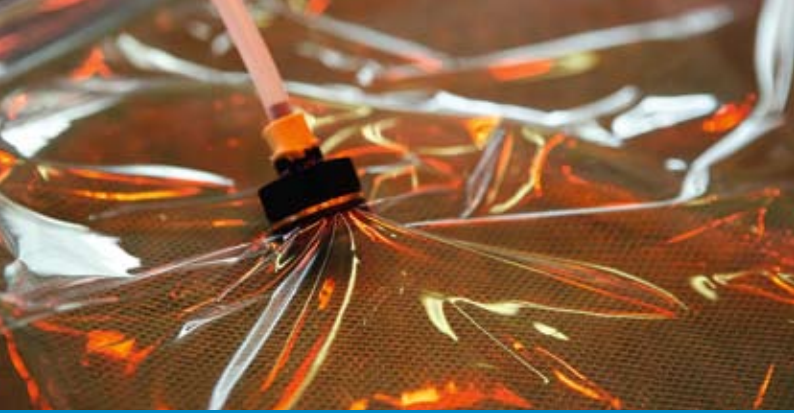


Special-purpose Test Rigs:

- Loading systems for qualification of multifunctional materials
- High dynamics test systems for applications up to 1000 Hz (e. g. for testing of microsystems, characterization of elastomers, etc.)
- Electrodynamic vibration generators, testing frequencies of more than 2000 Hz for batteries and electronic components

Materialography:

- Optical and scanning electron microscopy with EDX analysis, hardness testing to Vickers, Brinell, Rockwell, surface measurements
- Determination of fibre-volume content of polymer material by ashing
- Determination of humidity in polymer material



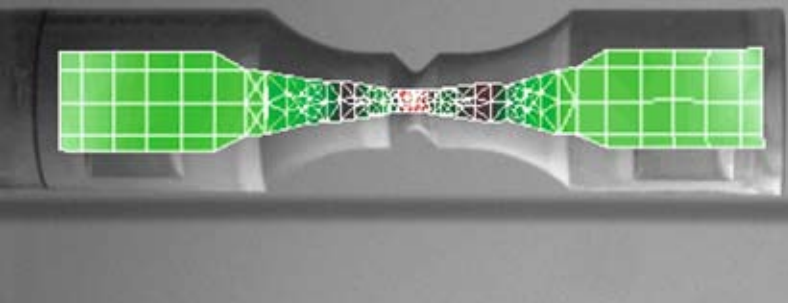
INNOVATIVE

Environmental Simulation under Cyclic Loading:

- Environmental test chambers for conditioning of specimens and components and simulation of environmental conditions, at temperatures ranging from $-70\text{ }^{\circ}\text{C}$ to $+350\text{ }^{\circ}\text{C}$ and/or humidity from dry to 98 % rH
- High temperature test facilities up to $1100\text{ }^{\circ}\text{C}$
- Systems for simulation of the influence of a variety of media, including, salt, brake fluid, fuels temperature regulation till $100\text{ }^{\circ}\text{C}$, or hydrogen

Fibre Reinforced Components Laboratory:

- Mould making using e.g. rapid-prototyping
- Manufacturing of composite specimen using prepreg, vacuum infusion, VAP, RTM
- Hot press up to $450\text{ }^{\circ}\text{C}$
- Hot air furnaces up to 1 m^3
- Cooling facility for prepreg storage
- Diamond and abrasive water jet cutting of specimen



FOR SURE.

LOAD ANALYSIS AND NUMERICAL SIMULATION

In addition to the experimental test services Fraunhofer LBF offers a comprehensive range of simulation solutions.

For more information, please refer to
www.lbf.fraunhofer.de/numerical-analysis

Please feel free to contact us at **info@lbf.fraunhofer.de**

For several standardized tests (e.g. wheel tests at biaxial wheel/hub test rig) we are accredited with DIN EN ISO/IEC 17025:2005



DGL-PL-3906.00



Fraunhofer

LBF

FRAUNHOFER INSTITUTE FOR STRUCTURAL
DURABILITY AND SYSTEM RELIABILITY

Contact

Fraunhofer Institute for Structural Durability
and System Reliability LBF

Bartningstraße 47, 64289 Darmstadt, Germany

Director: Prof. Dr.-Ing. H. Hanselka

Phone: + 49 6151 705-0

Telefax: + 49 6151 705-214

info@lbf.fraunhofer.de

www.lbf.fraunhofer.de



Innovative for sure.