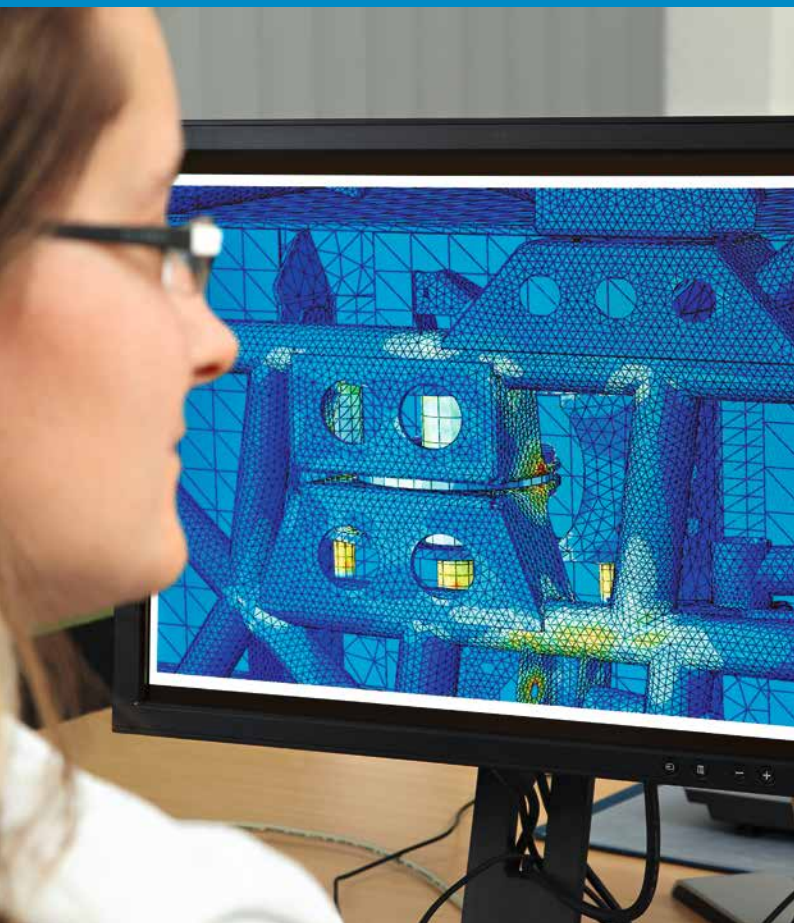
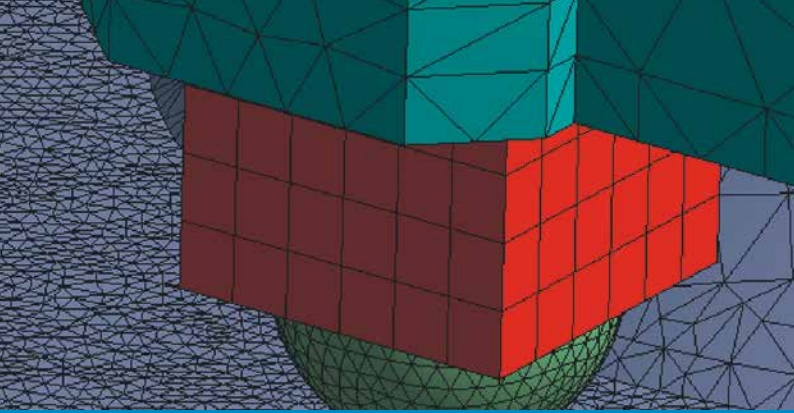


FRAUNHOFER INSTITUTE FOR STRUCTURAL
DURABILITY AND SYSTEM RELIABILITY LBF

REALISTIC SIMULATIONS

Individual solutions for you.





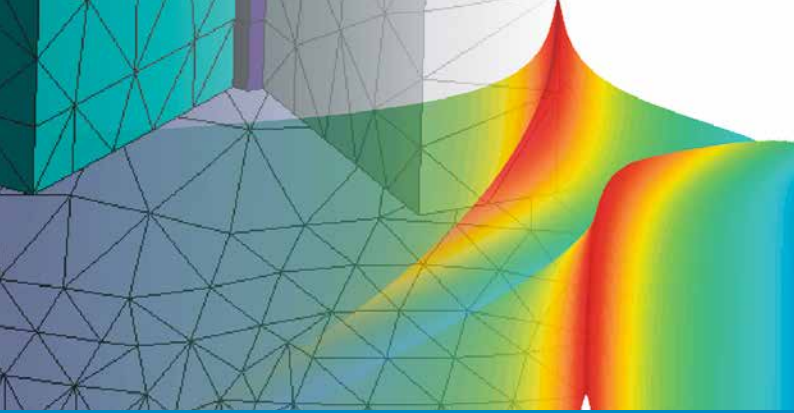
REALISTIC SIMULATIONS

The Fraunhofer Institute for Structural Durability and System Reliability LBF, with its 500 employees, offers its customers integrated solutions for the development and qualification of innovative structures, components and mechanical systems. Our expertise allows a systematic interlinking of experimental and numerical simulations.

With our know-how and versatile equipment, we can respond to your individual needs flexibly and speedily. We offer the numerical analysis of systems, their optimization and the development of passive and active components and systems.

You too can benefit from our close cooperation with trend-setting panels. Fraunhofer LBF realizes application-oriented, efficient solutions of the highest quality to support you in your product development:

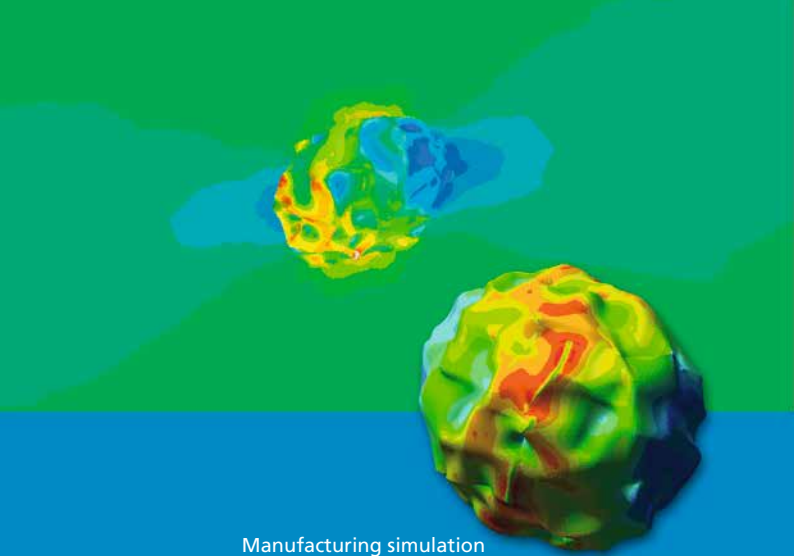
Innovative for sure.



SYSTEM ANALYSIS AND EVALUATION

We can evaluate your components and systems from static to dynamic, from cyclical to vibro-acoustic and from multi-physical points of view:

- Numeric component evaluation, taking into account manufacturing (master forming, forming, joining, notching, residual stress)
- Computational service life assessment and operating load simulation on the basis of measured load data
- Simulation of inhomogeneous material systems, such as composite materials
- Consideration of non-linear material behavior
- Analysis of multi-physical systems, such as electro-mechanical, thermo-mechanical or vibro-acoustic systems



Manufacturing simulation
optimizes component

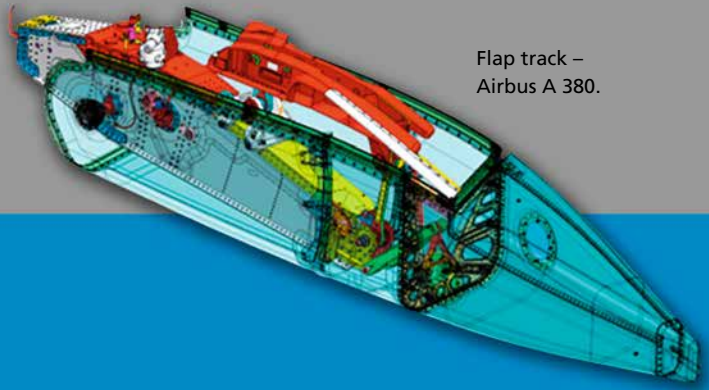
LET OUR EXPERTISE IMPROVE YOUR DEVELOPMENT PROCESS

We can dimension and design your components and systems in line with your demands:

- Topology and shape optimization with regard to functionality, durability, lightweight construction and manufacturing restrictions
- Load data analysis, e. g. through multi-body simulation, including the use of cross-domain simulations
- Development of smart mechatronic and adaptronic mechanical systems

We develop models to realistically describe material, component and system behavior:

- Modeling of smart actuator and sensor components on the basis of functional materials, such as piezo-electric ceramics, electro-active elastomers, magnetorheological fluids, shape memory alloys, etc.
- Development of non-linear material and structure models (e. g.: elastomer models, composite materials)



Flap track –
Airbus A 380.

- Multidisciplinary simulation – simulation code coupling
- Transfer of models in real-time applications

One of our strengths lies in the implementation of regulations, standards and approval conditions in efficient validation methods, tailored to the development process, for system properties.

Examples:

- Development of combined validation procedures (test/simulation) for component safety
- Development of methods for assessing the durability of metal and ceramic parts and also of components made of fibre reinforced and non-reinforced plastics

We also offer the development and integration of subroutines in commercial programs as well as of customized numerical tools.



DEVELOPMENT OF NEW SYSTEMS

Our research results can promote your products. Our close links with the Technical University of Darmstadt and participation in special research fields of the DFG as well as in other major scientific projects links us in with the basic research also in the field of numerical methods. Poised as we are at the interface between research and implementation, we can use this knowledge to optimally support your development work. You can also benefit from our expertise, anchored in strong networks, in the acquisition of project funding from the EU and federal and state governments.

Selected examples of developments with application maturity:

The virtual validation of mechatronic products requires the integrative simulation of multi domain product properties. Fraunhofer provides frameworks for the cooperative development and testing of functional prototypes of complex mechatronic products. The flexible framework **Functional DMU** is a non-monolithic software system and allows virtual models to be experienced functionally. When properly designed, fiber-plastic composites permit extremely lightweight construction and also enable functional integration. For instance, **a carbon fabric-**

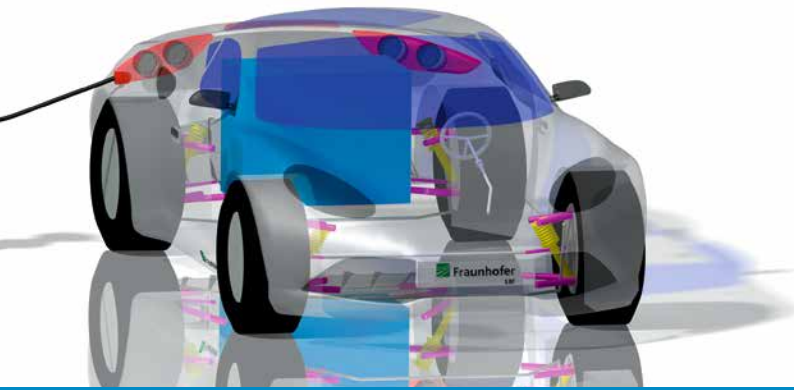


Active mounts for individual customer requirements.

reinforced plastic (CFRP) car wheel prototype with a built-in electric hub motor was recently designed, manufactured and tested at the Fraunhofer LBF.

At Fraunhofer LBF we also develop smart **adaptive dynamic vibration absorbers** for the purpose of the narrow-band influencing of system dynamics. Due to their ability to actively optimally adapt vibration features allows to design absorbers which have superior features when compared to conventional solutions. Depending on the requirements, different implementation mechanisms are available. The scalability of the solutions permits the introduction of compensation forces right up into the kN range.

Active mounts are used to improve the vibration properties of technical systems and are, for example, used as aggregate mounts in vehicles. Fraunhofer LBF develops and optimizes active mounts, including modelbased controllers, in accordance with your individual requirements. We also perform feasibility studies e.g. to assess the performance potential of the active complete system.



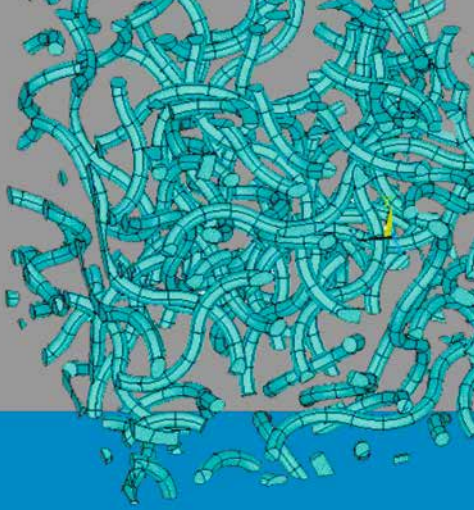
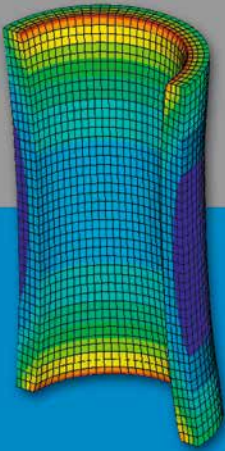
EFFICIENT TOOLS

Modern tools and the extensive experience gained from over 75 years of application-oriented research are your guarantee of economical work and reliable results.

In-house software developments (selection):

- Component design in line with the local strain approach:
The 3D method for the compatible evaluation of experimental tests for the determination of the cyclic characteristics of the Ramberg-Osgood and Manson-Coffin-Basquin equations and the ANSLC (artificial neural strain life curve) program, see www.web-aided-engineering.com
- Tire modeling and its application in total vehicle simulation with the tire model family CDTire (ComfortDurabilityTire).

We also offer training courses for our software.



Finite element model of an electro-active elastomer.

Standard software applications:

Interface software

- 3D_Evolution
(Conversion CAD-FEM)
- MOR for ANSYS
(Model reduction software)

Interdisciplinary software

- MATLAB/Simulink
- optiSlang
- TOSCA Testsuite
- Virtual.Lab
(BEM/FEM Akustik)

CAD

- Autodesk Inventor
- CATIA
- Pro/Engineer
- SolidWorks

Finite element Analysis

- Simulia Abaqus FEA
- ANSYS Composite PrepPost
- ANSYS Multiphysics
- MEDINA
- MSC.Marc
- MSC.NASTRAN with
MSC.Flight Loads
- MSC.Patran

Multi-body simulation

- MSC.Adams
- SimPack

Circuit design

- OrCAD (PSpice)



INNOVATIVE FOR

LBF[®].SOFTWARE PRODUCTS

The Stress & Strength GmbH company is a spin-off enterprise of Fraunhofer LBF and realizes successful software products on the basis of the Institute's scientific methods. Its core businesses are the development and sale of special software for time series and data analysis and the computational validation of operational durability. www.s-and-s.de

Product examples:

- LBF[®].DAP: Software for the analysis, processing and evaluation of data sets
- LBF[®].WheelStrength/LBF[®].HubStrength: Software for the evaluation of the operational durability of rotating suspension components
- LBF[®].SuspensionStrength: Concept for the evaluation of the operational durability of non-rotating suspension components

Our customers include leading companies in the automotive industry.



SURE.

EXPERIMENTAL TESTING SERVICES

At Fraunhofer LBF you will find a wide range of test equipment for experimental simulation to complement to our numerical analyses and simulations.

Learn more about our services below:

<https://www.lbf.fraunhofer.de/experimentelle-simulation>

Get in touch with us! **info@lbf.fraunhofer.de**

Contact

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Reliably innovative.