FEMFAT LAB vi

LOAD DATA ANALYSIS software

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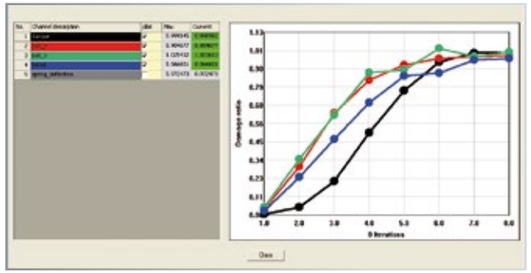
5. The iteration is completed as soon as a defined accuracy has been reached. A relative damage comparison of both signals, which can be performed with FEMFAT LAB, is often used as a criterion for exactness. A comparison of the frequency spectra is also possible.



Convergence result

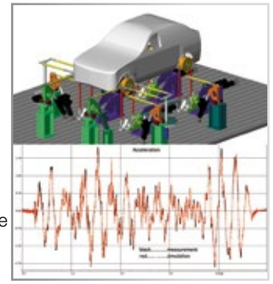
Typical problems in practice

Measurements of different vehicle axes (load in the joints and steering, suspension travel) are performed without the use of wheel force transducers on a test track. Parallel to this, a MBS model is created to determine the correct stresses and/or spectra of a sub frame or a knuckle for calculation of durability.
In order to meet these needs, the external loads, usually the hub loads and torques need to be calculated using the outlined iteration process based on existing measurements (various loads and suspension travel). If these hub loads are determined using virtual iteration with a predefined exactness, various values can be calculated such as the aforementioned internal forces or modal results for components under vibration stresses.

These can subsequently be used as a basis for service life evaluation with FEMFAT MAX. Second important application area of the virtual iteration is the calculation of vertical displacements used as input for a dynamical system. Absolute displacements cannot be measured but these are often necessary, especially for vertical direction of the load. Usually these global displacements can be determined from simple internal measurements like acceleration or relative displacement signals.

Such vertical displacements are typically used for

- Attachment parts, loads at frame or multiaxial simulation table
- Full vehicle simulation, loads at wheel center
- Generation of road profile, 4-poster simulation of full vehicle including vertical tire stiffness



Virtual free mass test rig

Benefits overview:

- Excellent convergence between measurement and simulation
- Automatic iteration process with MSC/ADAMS®, SIMPACK®, MotionSolve® and RecurDyn®

Interfaces:

- RPC • Remus • ASCII • DIADEM
- FEMFAT • Microsoft Office (WinWord/Excel)
- User specified data formats can be included.

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:BY MAGNA POWERTRAIN

Virtual Iteration

Binding Link between Test Track, LAB and CAE

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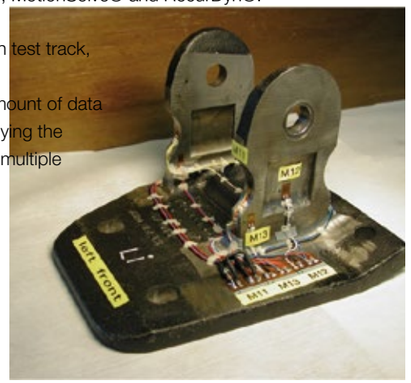
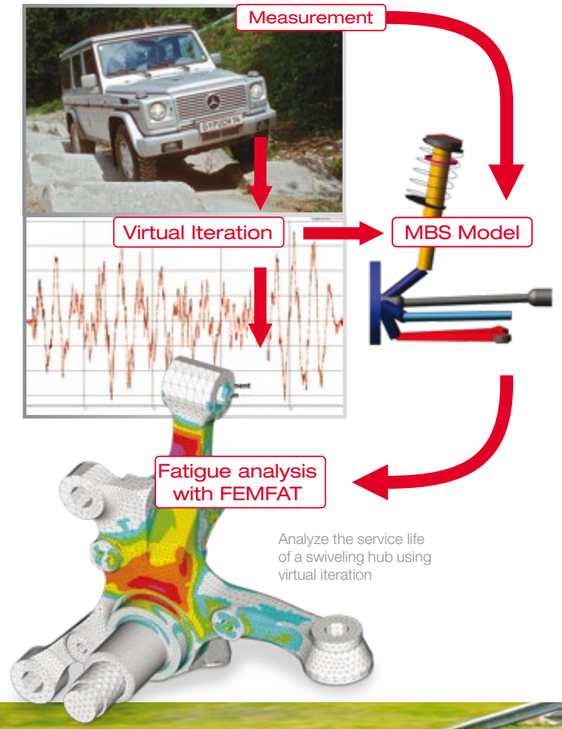
FEMFAT LAB is the binding link between test track, laboratory and CAE. It's a powerful software solution to visualize and analyze large amount of data. FEMFAT LAB analyzes time histories with millions of data points and hundreds of channels within seconds. Anomalies like drift, mean shift, spikes can be removed automatically or manually. Using the "project philosophy" of FEMFAT LAB time can be saved, because same operations for several files are carried out automatically without any user input.

FEMFAT LAB supports several binary data formats without any user interaction, application of FEMFAT LAB leads to cost and time saving due to the combination of multiple measurements for analysis, multi-axial methods for data reduction lead to reduced calculation time of FEMFAT MAX and test bench testing time, compatible to FEMFAT MAX and FEMFAT BASIC, MSC. ADAMS®, SIMPACK®, MotionSolve® and RecurDyn®.

- Binding link between test track, lab and CAE
- Analyses of large amount of data
- Time saving by applying the same operations to multiple files automatically



FEMFAT LAB vi Dynamic simulation depends in a large part on the used input data. Inputs from test bench or test track measurement often are not available or are extremely expensive to generate. Virtual iteration represents a well-rounded solution to this problem.



Analyze the service life of a swiveling hub using virtual iteration

General Principle

Virtual iteration is based on determination of excitation of a model in the time domain using a dynamic simulation (multi-body simulation). Using an iteration process with simulation (MBS) analogous to actual test bench testing can allow you to adjust external loadings placed on a structure in such a way that internal measurements, i.e. proper load flow, can be reproduced with the desired accuracy (solution of a non-linear inverse problem).

This can be used to replace procedures such as the time-consuming measurement of structure forces or loads with wheel force transducers. In contrast, internal measurements are usually relatively simple (such as wheel hub or chassis accelerations, suspension travel, etc.). The convergence in meansof damage ratio is generated automatically.

Automated iteration process

The virtual iteration can be used in connection with the MBS software MSC/ADAMS®, SIMPACK®, MotionSolve® and RecurDyn® automatically.

The interface to ADAMS uses the .adm file (ADAMS solver database) for the simulation of the dynamic model. The input of the model is defined by a RPC-file or by splines and the output by requests.

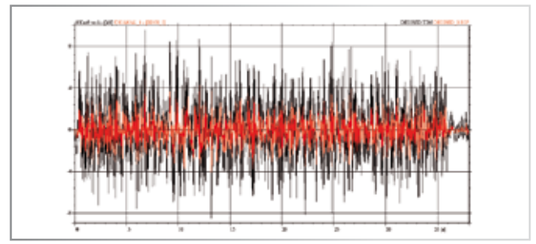
The interface to SIMPACK works over the SIMPACK command line using SIMPACK script commands. The input is defined by input functions and the output by a formatted ASCII file (.csv file).

Virtual iteration workflow

1. Noise generator: Calculates a pink noise to determine the transfer function of the model.
2. Simulation of the MBS model with the noise signals as input and a system response output.
3. Calculation of the transfer function. This is used as an approximation of the nonlinear MBS model and can be easily inverted

MBS model of a driven axle

4. One or more automated iteration steps are performed, i.e. calculation of the system input by applying the inverse transfer functions on the measurement, usually internal points.



Comperison of measured (black) and simulated (red) signal, e.g. acceleration at frame