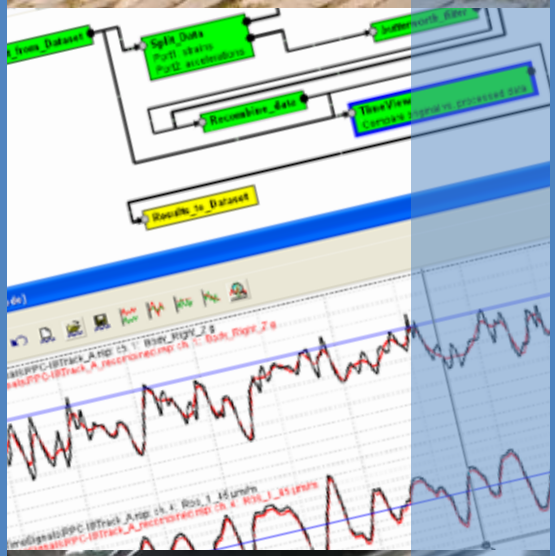

LMS TecWare

Efficient durability data processing

LMS®
ENGINEERING INNOVATION

LMS TecWare

An integrated approach to durability data processing

A critical factor for successful durability engineering is gaining a precise understanding of the loads that products will undergo during their anticipated lifetime. The availability of realistic load data is essential for virtual and physical product validation and optimization.

Whether load data is generated through extensive field testing, laboratory testing or numerical simulation, the last thing durability engineers want to do is spend months interpreting it.

LMS TecWare is a modular suite of solutions for durability load data processing. LMS TecWare streamlines the process of consolidating acquired load data, analyzing durability-specific characteristics and preparing for reliable simulations, proving ground and rig test campaigns – without requiring any cryptic commands or writing complex programs. This way engineers can gain more accurate insights into the durability performance of new product designs throughout the development process.

Everything you need for durability data processing ...

- Consolidate vast amounts of acquired load data
- Gain a precise understanding of the loads
- Analyze fatigue in-depth
- Accelerate durability test scenarios
- Design customer-correlated durability test schedules

... Designed for testing productivity

- Deliver more engineering insights from acquired data
- Increase the volume of analysis work
- Minimize errors through automated processing
- Reduce testing time without losing fatigue content

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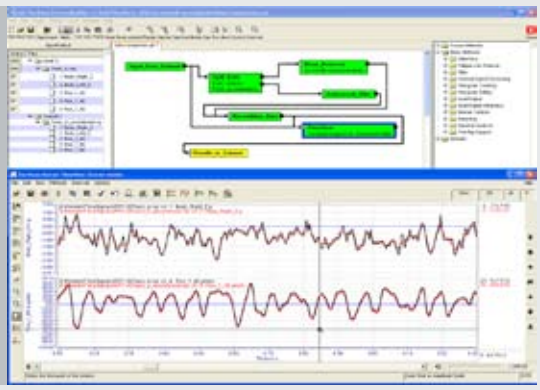
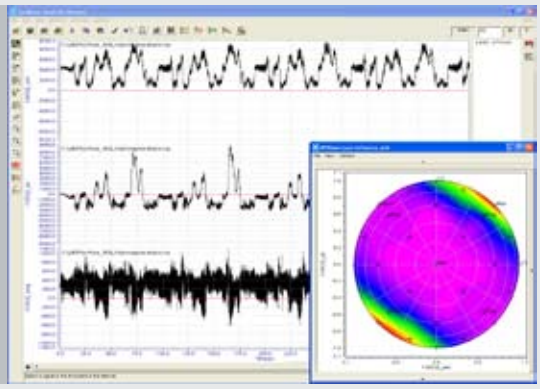
Consolidate vast amounts of acquired load data

LMS TecWare helps test engineers efficiently validate gigabytes of raw data from mobile data acquisition campaigns. A multitude of measurements - containing any combination of strain, load, moment, displacement, acceleration, tacho, pressure, temperature, CAN, GPS and wheel force transducer data are consolidated, either interactively on a channel-by-channel basis, or fully automated through standardized processes



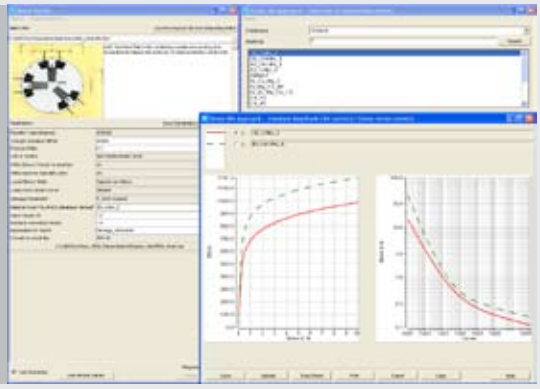
Gain a precise understanding of loads

LMS TecWare focuses on monitoring and comparing essential durability related aspects to select representative loading scenarios. A core capability of LMS TecWare is its extensive range of dedicated durability-specific data interpretation methods. These methods are based on statistics, rainflow and frequency analysis and help engineers efficiently qualify and quantify the load data durability potential.



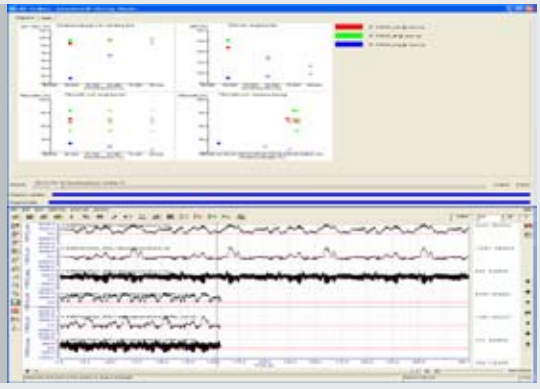
Analyze fatigue in-depth

LMS TecWare accurately estimates the fatigue life of a component, based on measured strain histories or individual tensors and cyclic material properties. It helps the user conduct a wide range of design sensitivity studies such as the variability of loading, materials, surface conditions and local geometry. As a result, you optimize the components' fatigue performance.



Accelerate durability test scenarios

LMS TecWare removes non-damaging events from long duration measurements to accelerate durability tests or simulations and helps engineers test more variants in the same amount of time. An optimal compromise between reduced testing time and preserved damage potential is guaranteed.



Design customer-correlated durability test schedules

Mapping the real customer usage of your product to a condensed durability test scenario is not obvious. With LMS TecWare, any guesswork is eliminated by calculating, via an optimization procedure, the optimal mix of test track sections that match the target customer usage with respect to fatigue.

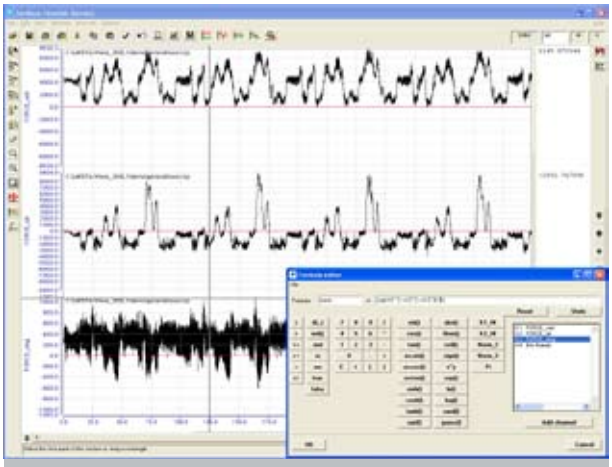
Streamlining data processing - accelerating durability engineering

Fast, easy and intuitive time data validation

LMS TecWare provides everything you need for fast, easy and intuitive validation of raw time signals: statistics, multi-channel time signal viewing, a pocket calculator for mathematical operations, a broad set of interactive editing tools, resampling, filtering and much more.

The software supports all common data formats - MTS RPC3, NI DIAdem, IST RigSys and nCode DAC - as well as ASCII, LMS Test.Lab and LMS Test.Xpress - and is specifically designed to handle vast amounts of data.

- Fast, intuitive and easy-to-use time data viewing and editing
- Compatible with all common data formats
- No file conversion, no waste of time or disk space
- Handling vast amounts of time data

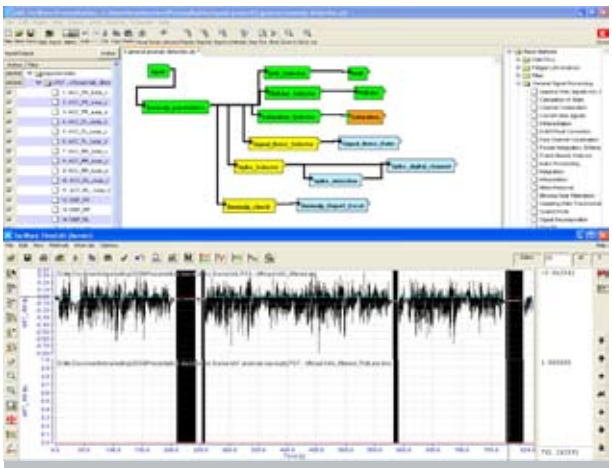


Everything you need for fast, easy and intuitive validation of raw time signals

Automated anomaly detection and correction

Since the interactive inspection and validation of each individual signal would take far too long, LMS TecWare can automatically locate any anomaly in the acquired load data. A Microsoft® Office Excel report summarizes all potential anomalies resulting from power failures, spikes, offsets, drifts and overloads. As a result, users only need to focus on a limited subset of data channels and time events which drastically accelerates the data validation process. The user corrects the anomalies either interactively, on a channel-by-channel basis, or fully automated through standardized processes.

- Efficient data consolidation with automated anomaly detection and cleanup
- Repeatable and consistent results, ready for further analysis

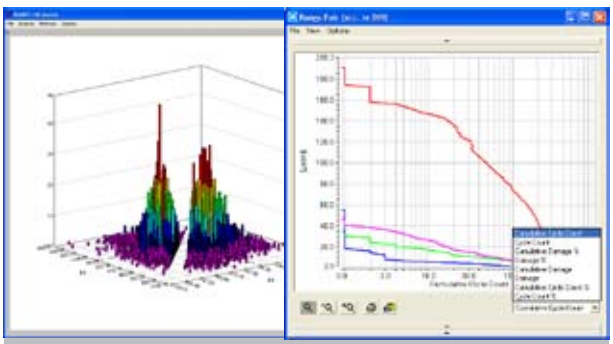


Automatically locate any anomaly in the acquired load data

Gain a precise understanding of durability loads

The extensive range of dedicated durability-specific data analysis methods – based on statistics, rainflow counting and frequency analysis – helps engineers efficiently qualify and quantify the load data durability potential. A wide range of embedded display capabilities helps users quickly assess the durability impact of various road surfaces, compare loads collected using multiple sensors or correlate test and simulation results. Displays include: from-to or range-mean cycle count visualization, single-click switching between rainflow and range-pair or level crossing view, on-the-fly translation of cycles into pseudo-damage and visualization of pseudo-damage as a function of GPS position on Google™ Earth maps.

- Complete toolset for durability load data analysis and synthesis
- On-the-fly interactive usage as well as streamlined analysis
- Compliant with SAE, AFNOR and DIN standards



Quickly access the durability impact of various road surfaces

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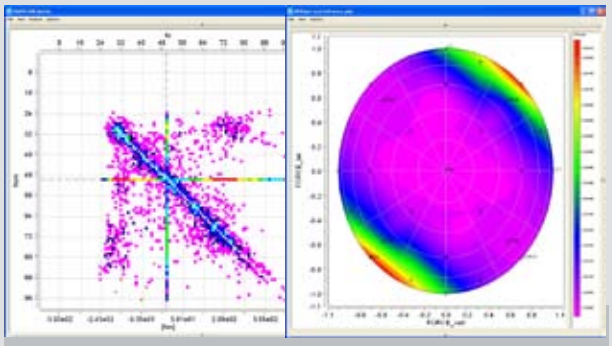
Get more out of your data

LMS TecWare incorporates innovative technologies co-developed and validated with leading automotive OEMs that help you get more out of your data. Optimize your components' fatigue performance by running in-depth fatigue life analyses on measured strain histories, gain a better understanding in multi-axial loading conditions (e.g measured using wheel force transducers) through multi-axial rainflow counting. Perform dedicated rainflow analysis on shafts or gears using rotating rainflow counting.

- Extract more out of your data – in-depth fatigue analysis, insight into multi-axial loading conditions, rotating component analysis
- Optimize your components' fatigue performance
- Innovative technology co-developed and validated with leading automotive OEMs

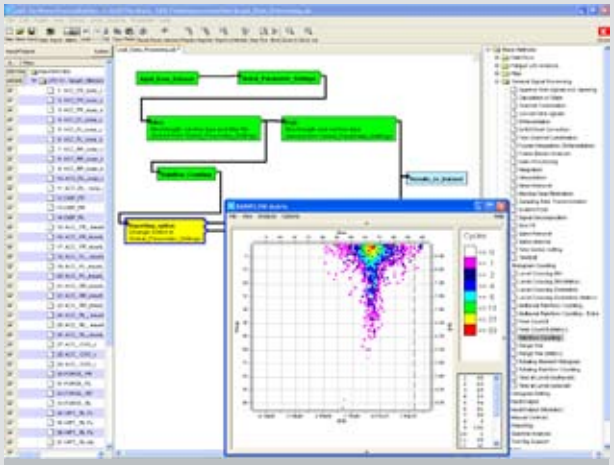


In-depth fatigue analysis, insight into multi-axial loading conditions, rotating component analysis

Streamlined analysis to increase testing productivity

By streamlining the analysis an increased amount of work can be performed in the same time span. Repetitive tasks can be executed automatically, operator errors are eliminated, and company processes can be standardized. The LMS TecWare ProcessBuilder is a dedicated graphical environment for defining, optimizing and executing an unlimited number of analysis tasks. No programming skills are required since tasks are intuitively defined by dragging, dropping and connecting individual analysis steps. Procedures set up in LMS TecWare ProcessBuilder can be executed around the clock without any user interaction.

- Increased amount of analysis work in same time span
- Designed for non-experts
- Consistent, error-free results
- Standardize on company-wide analysis procedures
- Pre-installed processes for common tasks

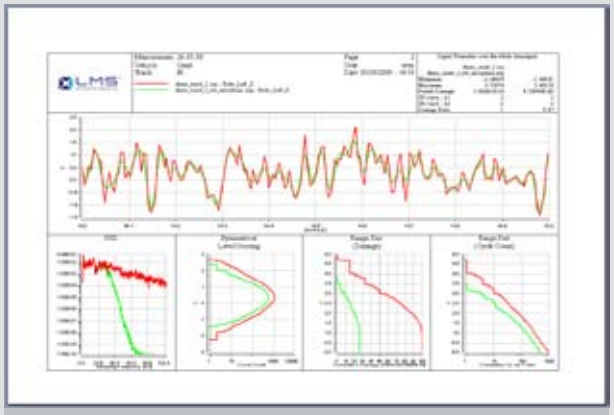


By streamlining the analysis an increased amount of work can be performed in the same time span

Powerful reporting

Besides template-based standard reporting, LMS TecWare provides the possibility to organize report content and layout in line with personal preferences and company guidelines. LMS TecWare automatically generates reports directly as web pages or to Microsoft® Office Word or Excel. Reports can consist of any combination of time histories, rainflow matrices, frequency information, statistics and fatigue predictions. This flexibility allows you to select the right representative loading scenarios for further test and simulation durability engineering. It also gives you an improved correlation between different sets of load data, no matter where the data comes from.

- Clear reports with all engineering insights to support decision-making
- Immediate results into standard Microsoft® Office
- Easy-to-use, template-based
- Configurable to company guidelines



Automatic generation of reports into standard Microsoft® Office

Accelerate long duration test scenarios based on usage profiles

Extensive field tests to validate the durability performance of mechanical designs are a very expensive and time-consuming process. To cut costs, more and more manufacturers are replacing actual vehicle tests by equivalent accelerated laboratory tests or virtual simulations.

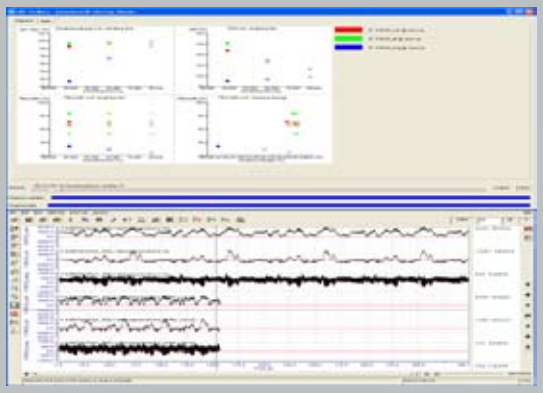
LMS TecWare supports this critical shift by efficiently defining sets of compressed load time histories that preserve the same damage potential as originally present – making it possible to generate new test schedules and optimize existing ones. Engineers can test more variants in the same amount of time and speed up testing cycles significantly.

LMS TecWare offers tools that, for example, simplify a test that reproduces actual load data signals to a constant amplitude test with equal damage potential. LMS TecWare also removes non-damaging events from long duration measurements in order to shorten the durability tests and therefore accelerate the testing cycle significantly.

Mapping the true customer usage of your product to a condensed durability test scenario is not obvious. With LMS TecWare, any guesswork is eliminated by calculating, via an optimization procedure, the best mix of test track sections that match the target customer usage with respect to fatigue.

- **Reduce testing time without losing fatigue content**
- **Gain a higher return from existing testing facilities**
- **Improve durability performance by designing customer-correlated test schedules**

Customer-correlated test schedule by mapping customer usage to proving grounds.



Accelerating durability component testing by removing non-damaging events

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LMS Durability Engineering solutions

Optimizing durability performance

LMS offers a unique portfolio of products and services covering the entire durability process. From realistic design and validation with accurate loads, to accelerated durability testing, to simulation techniques assessing durability performance in the earliest part of the design cycle, LMS has the right solution to make those critical go-the-distance improvements to your design process.

LMS SCADAS Durability Recorder

Mobile data acquisition for tough environments

LMS SCADAS Durability Recorder is specifically designed for truly rugged data acquisition in extreme conditions.

LMS Virtual.Lab Durability

Design optimization using LMS simulation

LMS Virtual.Lab Durability is a simulation solution to analyze the strength and fatigue of components and systems. Dedicated post-processing helps engineers get feedback on critical areas and understand root causes of fatigue problems.

LMS Test.Lab Vibration Control

Complete solutions for vibration and shock testing

LMS Test.Lab Vibration Control helps test engineers certify and homologate their products. The system offers accurate closed-loop shaker control and a maximum of built-in safety mechanisms, minimizing risks of damaging costly test items.

LMS Engineering Services

Solving critical engineering challenges

LMS Engineering Services helps customers optimize product designs and address tough engineering challenges. The LMS approach to functional performance engineering can truly be a strategic competitive advantage for every company.

LMS Customer Services

A partnership for your success

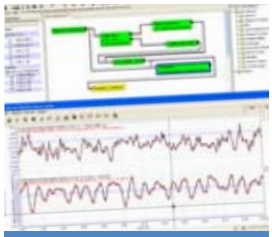
LMS offers a complete portfolio of professional services from installation management to hardware calibration, on-site training and knowledge transfer. This results in optimized productivity and systems with the latest technology.

The Durability Alliance

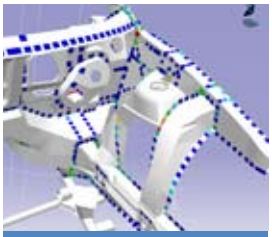
“The Durability Alliance” - a close partnership between LMS, Instron Structural Testing Systems and Kistler - ensures a tight integration of durability related testing and simulation software through joint developments.

Understanding Operational loads › **Target Setting & Test Procedures** › **Design Optimisation Virtual Product Validation** › **Physical Product Optimisation & Validation** › **Final Product Test**

LMS SCADAS Durability Recorder



LMS TecWare Load Data Processing



LMS Virtual.Lab Durability

LMS Test.Lab Vibration Control

LMS SCADAS Durability Recorder

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LMS is an engineering innovation partner for companies in the automotive, aerospace and other advanced manufacturing industries. With approximately 30 years of experience, LMS helps customers get better products to market faster and turn superior process efficiency into key competitive advantages.

With a unique combination of 1D and 3D simulation software, testing systems and engineering services, LMS tunes into mission critical engineering attributes, ranging from system dynamics, structural integrity and sound quality to durability, safety and power consumption. With multi-domain solutions for thermal, fluid dynamics, electrical and mechanical system behavior, LMS can address the complex engineering challenges associated with intelligent system design.

Thanks to our technology and dedicated people, LMS has become the partner of choice of more than 5,000 leading manufacturing companies worldwide. LMS is certified to ISO9001:2000 quality standards and operates through a network of subsidiaries and representatives in key locations around the world. For more information on LMS, visit www.lmsintl.com.

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