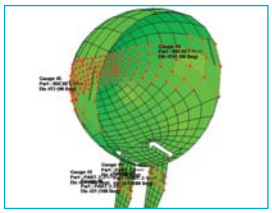
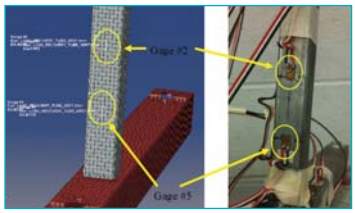
Product Brief

fe-safe/True-Load™

Strain Correlated FEA Load Calculation for fe-safe®





Types of Components:

fe-safe/True-Load™ is ideal for components subject to complex loading such as:

- on and off road vehicles
- aerospace structures
- mining and construction
- piping systems
- bridges and buildings

Advantages of using fe-safe/True-Load™:

- Loading events are one of the critical elements for performing fatigue analysis. fe-safe/True-Load™ creates correlated load histories for fe-safe®
- Strain gauge placements for maximum load sensitivity are determined in fe-safe/True-Load™
- FEA Strain correlation typically within 2% of measured strains for the entire loading history

Key fe-safe/True-Load™ Capabilities:

For complex structures and components fe-safe/True-Load™ provides a unique capability to understand the entire loading event by coupling the FEA model and measured strain data. fe-safe/True-Load™ leverages the model for:

- unit load case definition
- gauge placement
- XY plots of node and element response
- full-field results for any time domain

fe-safe/True-Load™ is an Abaqus CAE plug-in that allows seemless integration of Abaqus results and loading data into fe-safe®. It manages complex loads over the entire loading event by coupling the FEA model with measured strain data.

fe-safe/True-Load™ uses the data from a handful of strain gauges to understand the structural response of the entire model. This type of knowledge is critical to understanding the loading environment on structures and performing accurate fatigue calculations.

fe-safe/True-Load™ transforms complicated structures into load transducers by utilising results from user-defined unit loading to determine ideal strain gauge locations and orientations for optimal load sensitivity. Suggested strain gauge locations can be interactively modified by the user through True-Load/Pre-Test with immediate feedback regarding the load transducer effectiveness.

Collected strain data is then post-processed through True-Load/Post-Test using the correlation matrix from True-Load/Pre-Test to calculate the load scaling functions. Strain correlation with fe-safe/True-Load™ is achieved with remarkable accuracy – typically within 2% of measured values. fe-safe/True-Load™ outputs an event file so that the entire model can be easily explored.

Advantages:

fe-safe/True-Load™ has several advantages:

- provides unparalleled accuracy in loading events
- maximises learning from experimental testing
- saves time – reduces weeks of work to minutes
- provides re-usable data for evaluating design iterations

Requirements:

fe-safe/True-Load™ requires:

- Abaqus CAE software, model and results
- fe-safe® software
- Strain gauge measurements in digital format

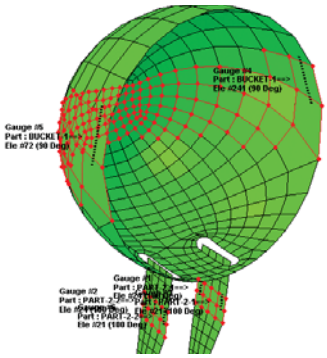
Technical background

Structures undergo elastic deformation due to a wide range of loading combinations. By using user-defined unit load cases, fe-safe/True-Load™ searches the FEA model for gauges that best satisfy the equation: $[\varepsilon][C]=[F]$

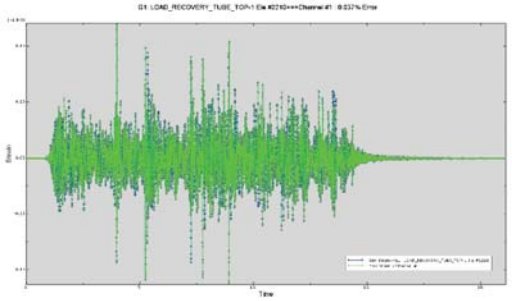
The load proportionality matrix [C] is calculated from virtual gauge locations in the FEA model via: $[C]=[\varepsilon^T \varepsilon]^{-1}\varepsilon^T$

While a large number of possible strain gauge locations are possible, the load proportionality matrix [C] found by fe-safe/True-Load™ is mathematically the most robust relationship in the FEA model. This guarantees a strain correlation with remarkable accuracy – typically within 2% for every strain channel.

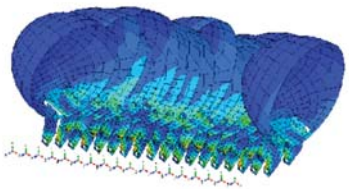
In addition to the scale-and-combine event creation in fe-safe®, the loading time histories are also organised into 'quasi-static event' files (.qse) for post-processing in Abaqus CAE. The quasi-static functionality allows the analyst to create XY plots for any node or element in the model. Full-field results for any subset of the time domain are also available.



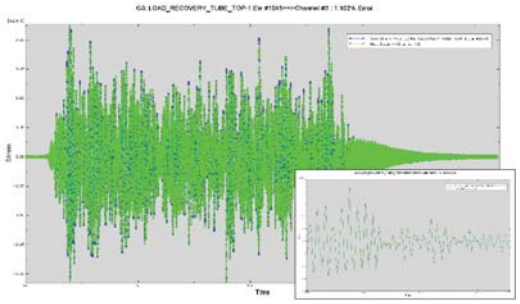
Virtual Gauge Placement



Measured and FEA Strain Comparison: Gauge 1



Animation of Full Field Results
Extrapolated from Strain Measurements



Measured and FEA Strain Comparison: Gauge 3

Wolf Star Technologies

Wolf Star Technologies offers FEA consulting services to assist with delivering decision ready solutions for clients' projects and offers truly unique software solutions (True-QSE™, True-Load™ and True-LDR™) available nowhere else in the FEA industry.

The software suite enables analysis driven product development by focusing on test correlation, quasi-statics and linear dynamics. These solutions are seamlessly integrated into the Abaqus CAE environment with direct interfaces to fe-safe®.

safe technology limited

Safe Technology Limited is the technical leader in the design and development of durability software and is dedicated to meeting its customers' most demanding applications.

As a private company, Safe Technology is able to take a long-term view of software development and the research and industry collaboration needed to address real world, industrial applications. Its independence and focus enables quick response to customer feedback so that its software genuinely reflects the industrial and commercial requirements of engineers and designers.

In-depth knowledge of fatigue combined with expertise in software development allows Safe Technology to provide outstanding service - with standard and advanced training, software support, and consulting services provided by fatigue experts.

Safe Technology develops, markets and supports its software products directly from offices in the UK and USA, by a network of independent distributors worldwide and via the worldwide SIMULIA network.

To learn more, please visit our website where you can learn about our software products and related services, and register to download technical papers by our users on real world applications. You can also find the contact details for your local office or representative.

If you would prefer to give us a call, please contact one of our main offices:

Worldwide: +44 (0) 114 268 6444
North America: +1 310 714 0792

safe technology

Safe Technology Limited
Willis House, Peel Street, Sheffield, S10 2PQ, UK

Tel: +44 (0) 114 268 6444 Fax: +44 (0) 114 303 0055
Email: info@safetechnology.com Website: www.safetechnology.com