## Open WELD database

A database for MIG/MAG welds for steel and aluminum as well as for steel laser welds is provided. It includes notch factors, S/N curves and Haigh diagrams for more than 60 welding joint types. The database can be adapted and extended by the user with new joint types for special applications.

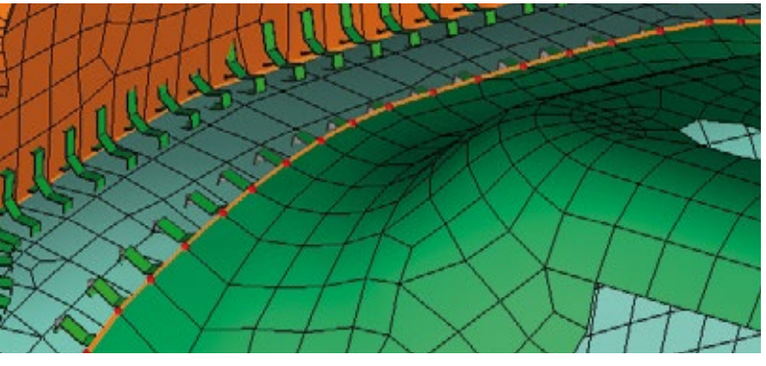
## Your Benefits

- Methods verified by numerous tests on components and specimens
- Fast definition of welding lines using the VISUALIZER
- Open database structure applicable to new weld types
- Results nearly independent of element size
- Supports shell and solid elements
- Assessment of the complete weld seam (start, mid, end)
- Interfaces to all common FEM codes
- Influence of elevated temperatures, mean stress, sheet thickness and base material strength can be considered
- Supports standards like Eurocode, DVS and British Standard

## FEMFAT Interfaces

• ABAQUS • ADAMS • ADVC • ALTAIR • ANSYS • COSMOS
• CREO • DIADEM • DIGIMAT • ESI • I-DEAS • LS-DYNA
• MARC • MEDINA • MoldFlow • MotionSolve • NASTRAN
• nCode • PATRAN • PERMAS • Pro/MECHANICA • Radioss
• RPC • SIMPACK • TECMAT • TOSCA

FEMFAT weld is an optional module for the fatigue analyses in combination with FEMFAT basic, FEMFAT max and SPECTRAL.



FEMFAT weld

FINITE ELEMENT METHOD FATIGUE

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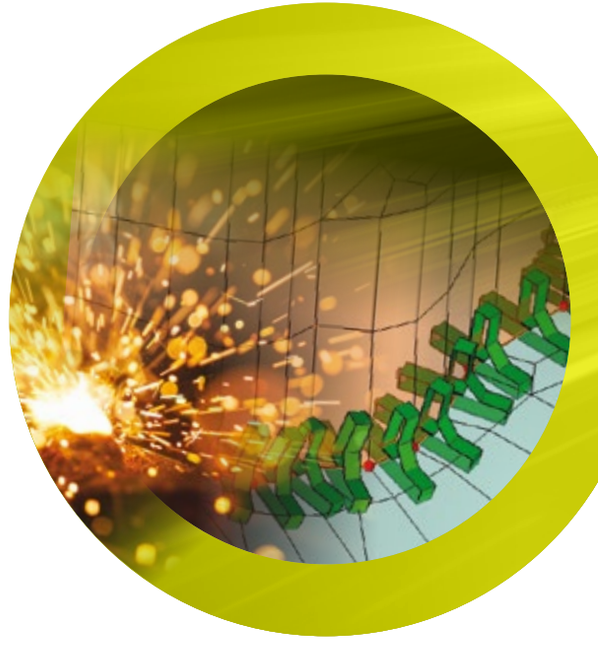
FEMFAT weld

BY MAGNA POWERTRAIN



# Weld Fatigue Analysis

- Welds assessment of FE structures
- Advanced analysis methods
- Open database structure
- Automatic weld definition

femfat.magna.com

## Weld Fatigue Analysis

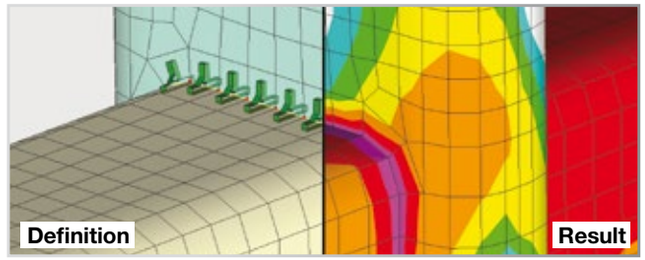
**Welded components have a considerably reduced ability to sustain dynamic loads; hence, numerical simulation of welded components is an important issue in CAE. To solve this problem, concepts for the automatic assessment of dynamically loaded welds have been developed and implemented in FEMFAT weld. Results are damage/life or endurance safety factors. Detailed results are available in the report file after analysis, or in the FEMFAT visualizer for post processing.**

## Method

Welds are defined with the help of a simple modeling guideline based on a shell element models (node and element attributes) or solid element models (group attributes). This weld definition can be performed either before or after the FEM analysis. Different concepts have been implemented, enabling an assessment of welds with the focus on forces or stresses.

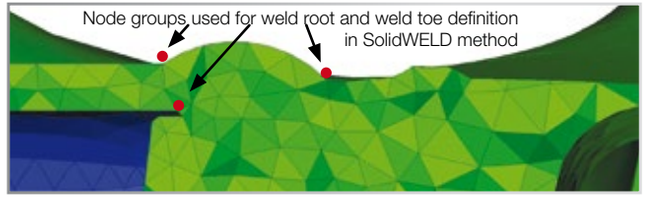
### Stress-based assessment

During the analyses process the structural stresses are scaled using direction-dependent notch factors originally determined using „RADAJ“ models and then enhanced, including test bench results. These notch stress results are used for further weld fatigue life predictions, taking into consideration mean stress, sheet thickness, load flow, temperature, material strength and statistical influence. A valuable option for defining seam welds for fatigue prediction is provided using FEMFAT visualizer. The automatic weld definition can be realized with just a few mouse clicks in the VISUALIZER or predefined with the Weldseamscanner. Small thumbnails are displayed inside the FE-model to prevent errors.



Weld definition (standard method)

FEMFAT weld in combination with the module ChannelMAX provides additionally a simplified SolidWELD method, which makes a fast and precise evaluation possible. Weld seams are defined on the basis of a coarse volume mesh, without radii, reducing big modelling effort.



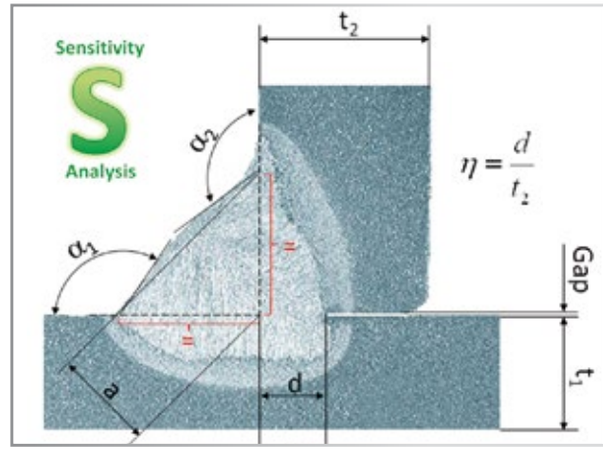
Definition of groups including nodes for weld root/toe and start/end for SolidWELD method.

### Force-based assessment

A second method based on nodal forces is available in addition to the standard method. The benefit of this method is that variations of seam geometry can situations can be quickly computed. Parameters such as the weld seam thickness or the weld penetration degree can be modified, thus allowing the impact on damage or safety factors to be studied.

## Features

- Fatigue evaluation of the local weld area, including relevant notch stresses at weld toes and roots
- Special analysis method to consider start/ends of welds
- Methods for shell, solid and mixed FEM models of weld seams are available
- Three-dimensional assessment of seam welds (considering the anisotropic strength of welds)
- Consideration of different types of loading and sheet thickness influence and temperature
- Method to reduce mesh dependency of results
- Automated weld sensitivity analysis to check geometry influences (weld penetration (η), seam thickness (d), seam inclination angle (α), weld gap)
- Script for fully automatic weld definition of hundreds of weld lines



Geometry parameters for weld sensitivity analysis