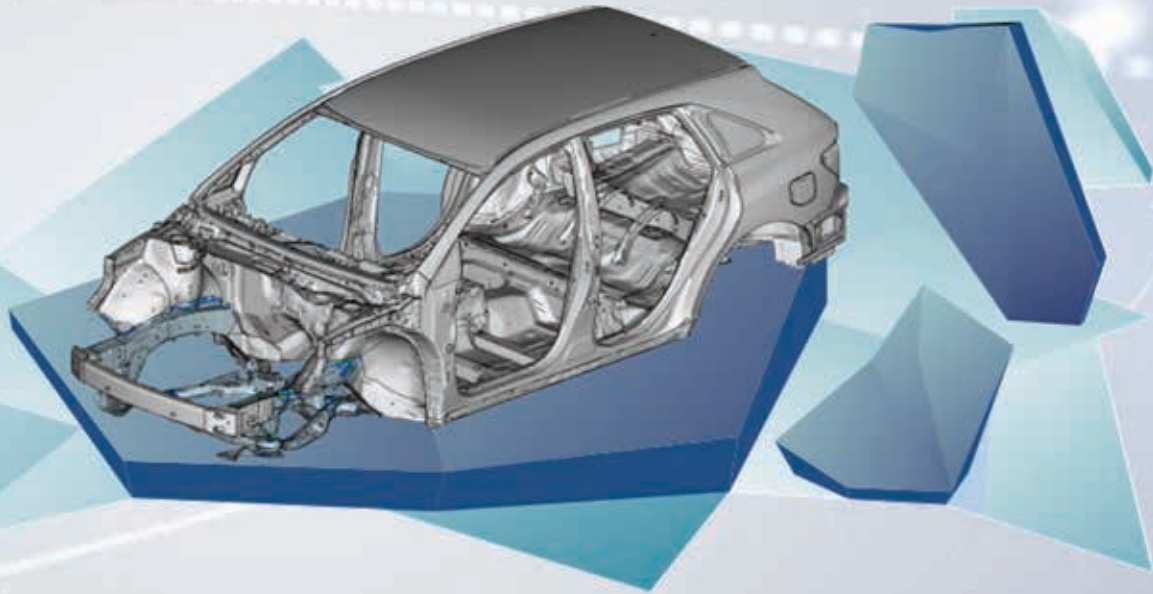
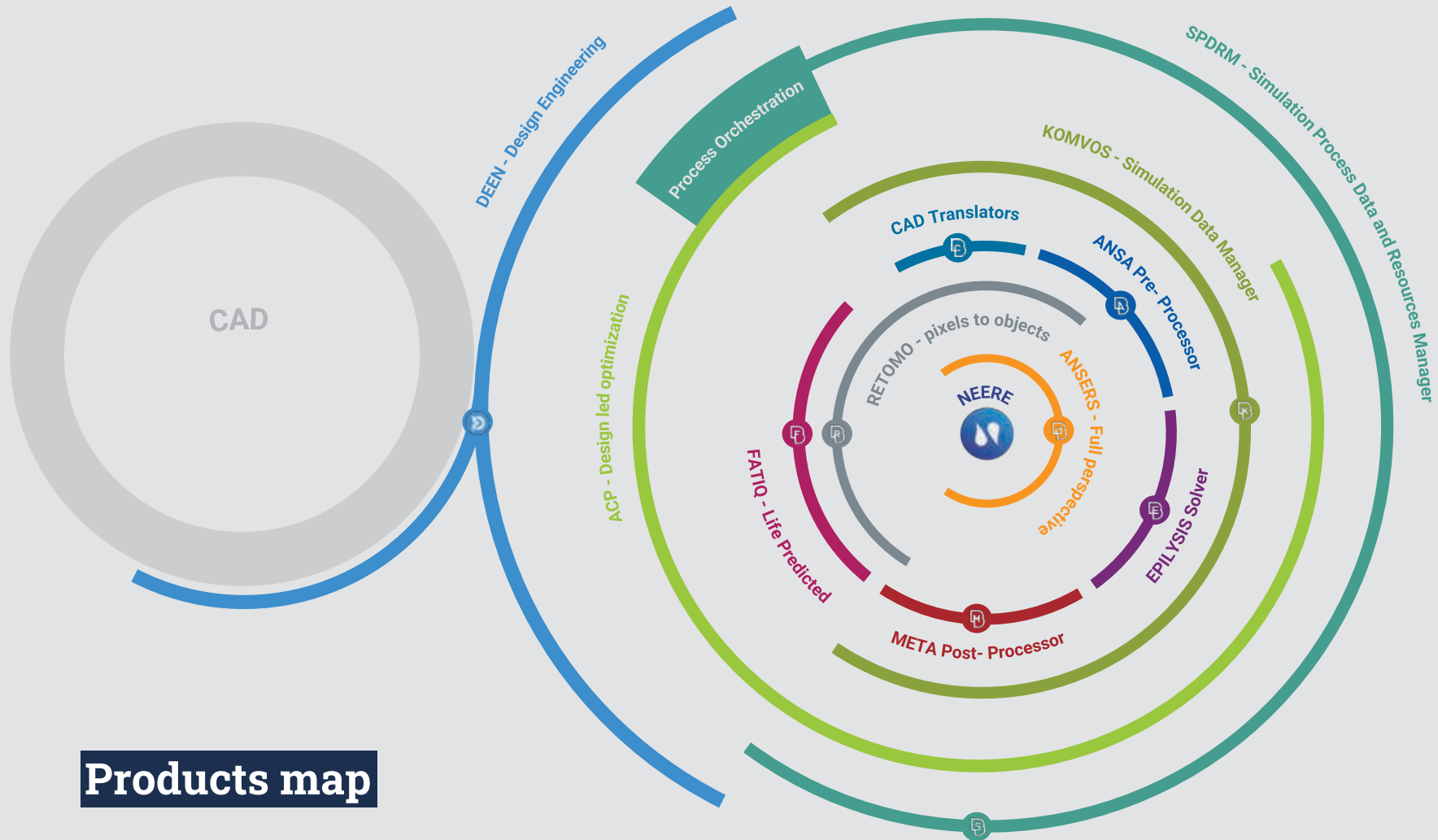


FATIQ
LIFE PREDICTED



Fatigue life prediction
made easy



Products map

What is FATIQ

Stress – Life method

Palmgren-Miner rule

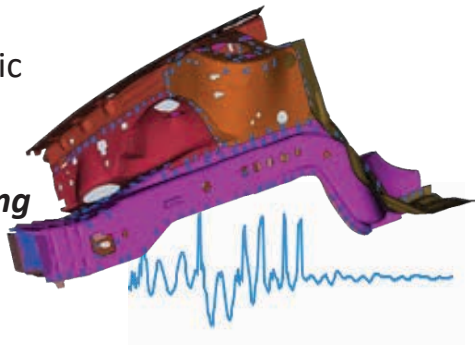
Time domain

Input

Pseudo - static
Transient

Cycle Counting

Rainflow



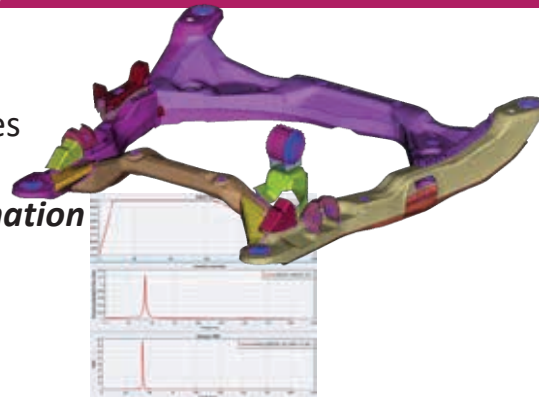
Frequency domain

Input

FRF
PSD Stresses

Cycle Estimation

Dirlik
Rayleigh
Rice
Powell



Mean stress correction

Goodman
Gerber
Soderberg

What is FATIQ

Strain – Life method

Palmgren-Miner rule

Time domain

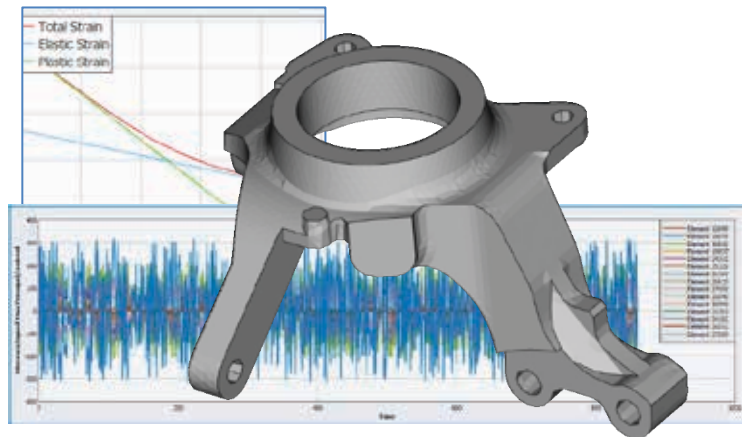
Input

Pseudo - static

Transient

Cycle Counting

Rainflow



Mean stress correction

Smith-Watson-Topper

Morrow

Customer requests

"Can you enhance random response tool of META in order to calculate fatigue results?"

"Does EPILYSIS support embedded fatigue keywords?"

"Is there a session command available in META in order to perform the rainflow algorithm?"

"Do you (as BETA) provide any scripts that calculate fatigue?"

"Can I use the META interface and tools on fatigue results?"



Goals

1

Intuitive software with minimal user input

2

User-friendly for all levels of expertise

3

Streamline analysis setup with reusable workflows

4

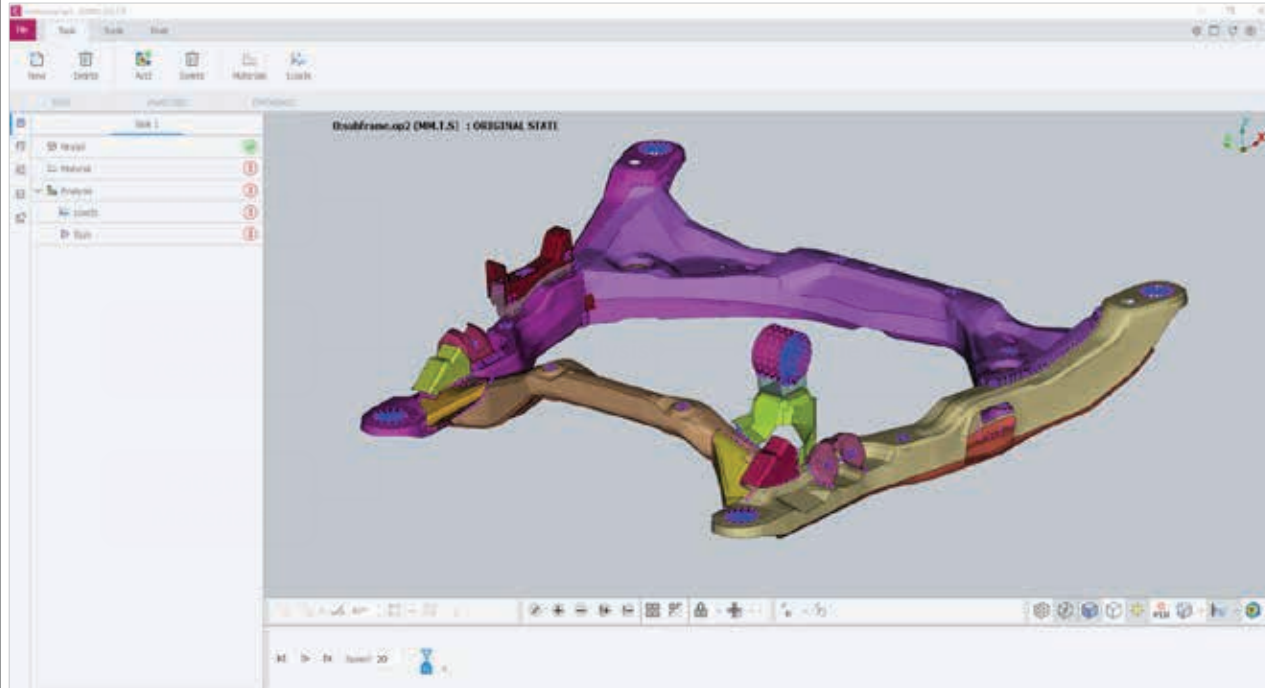
Interactive and comprehensive results overview

5

Rapid and reliable results



Key features

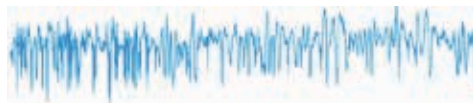


Workflow set-up

- Set up your analysis in a stepwise manner.
- Suitable from novice to expert users.
- Minimize user-imposed errors.

Key features

Task 1		
Model		!
Material		!
Analysis		!
Loads		!
Run		!
Analysis 2		!
Loads		!
Run		!
Analysis 3		!
Loads		!
Run		!



Workflow set-up

- Set up multiple analyses for the same model

Key features

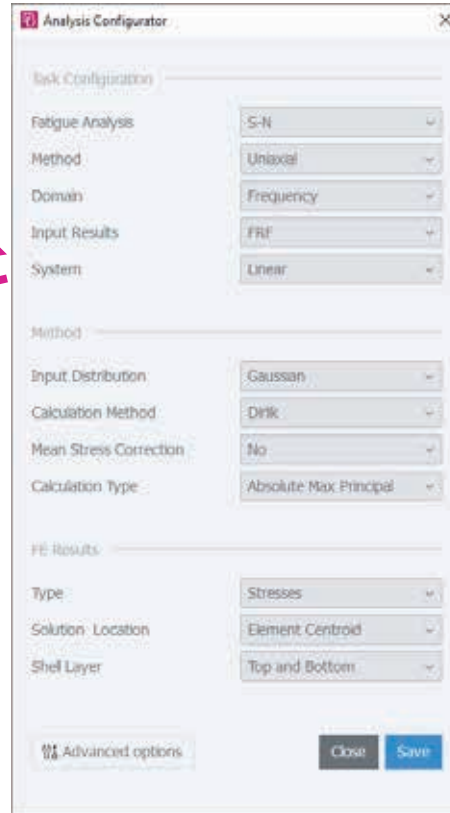
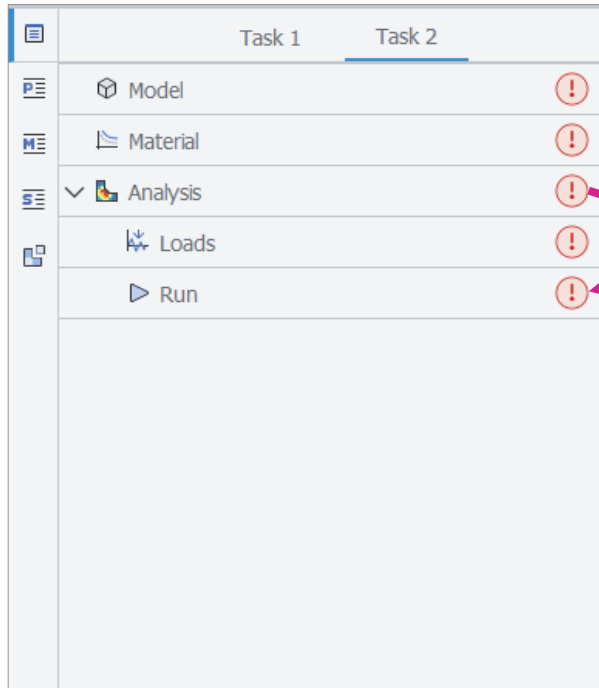
	Task 1	Task 2
Model		!
Material		!
Analysis		!
Loads		!
Run		!



Workflow set-up

- Set up workflow tasks with different models in a single session.

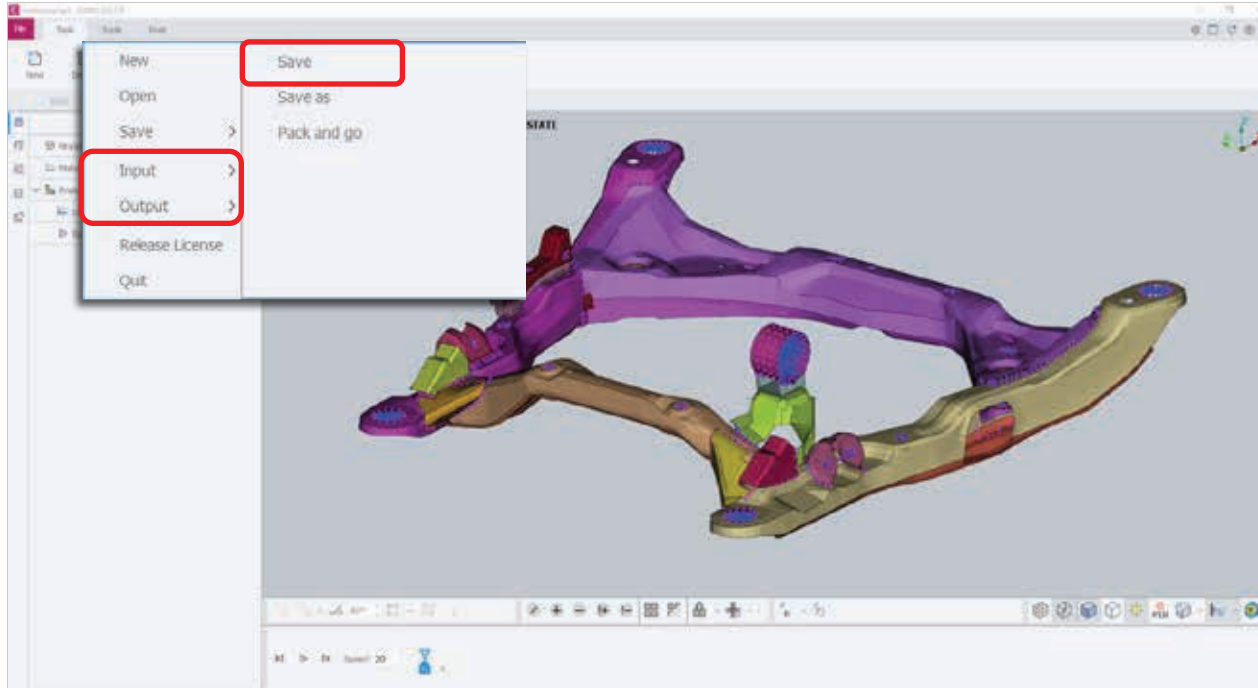
Key features



Workflow set-up

- Set up the analysis workflow with the aim of the Analysis Configurator

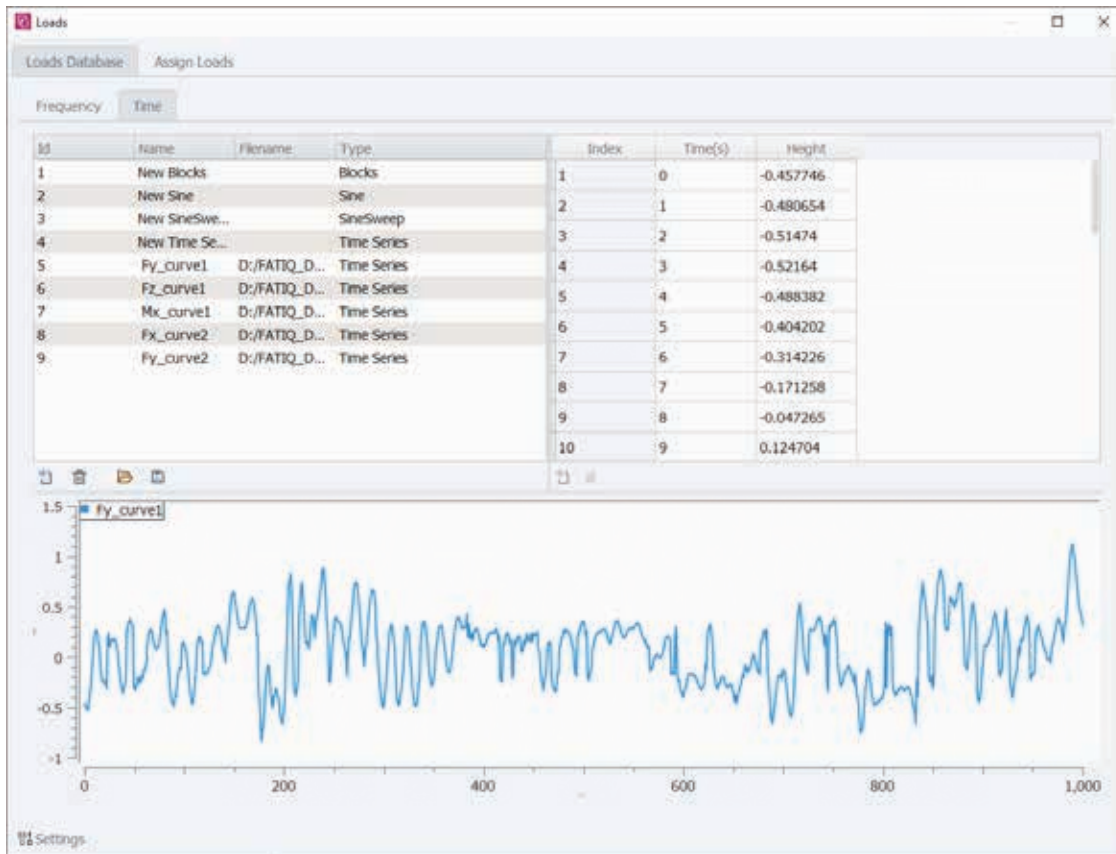
Key features



Interface

- Reads FE results from NASTRAN, ABAQUS, ANSYS and METADB.
- Saves workflow templates in XML format.
- Saves the complete Pre- and Post Processing work in a project.
- Pack and Go option to compress project in a single file.
- Runs in batch mode

Key features



Load database

- Load definition

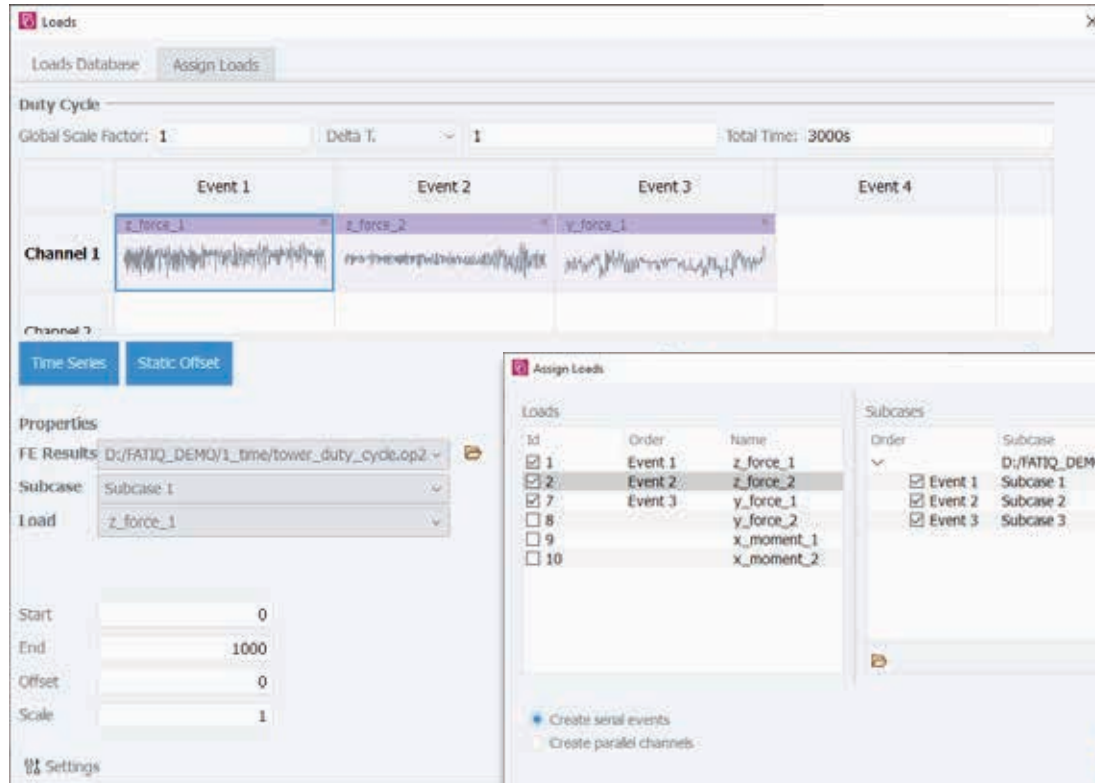
Frequency

- PSD
- Sine
- Sine Sweep
- Narrow Band

Time

- Time Series
 - Amplitude Blocks
 - Sine
 - Sine Sweep
- Reading load curves from various solver formats.

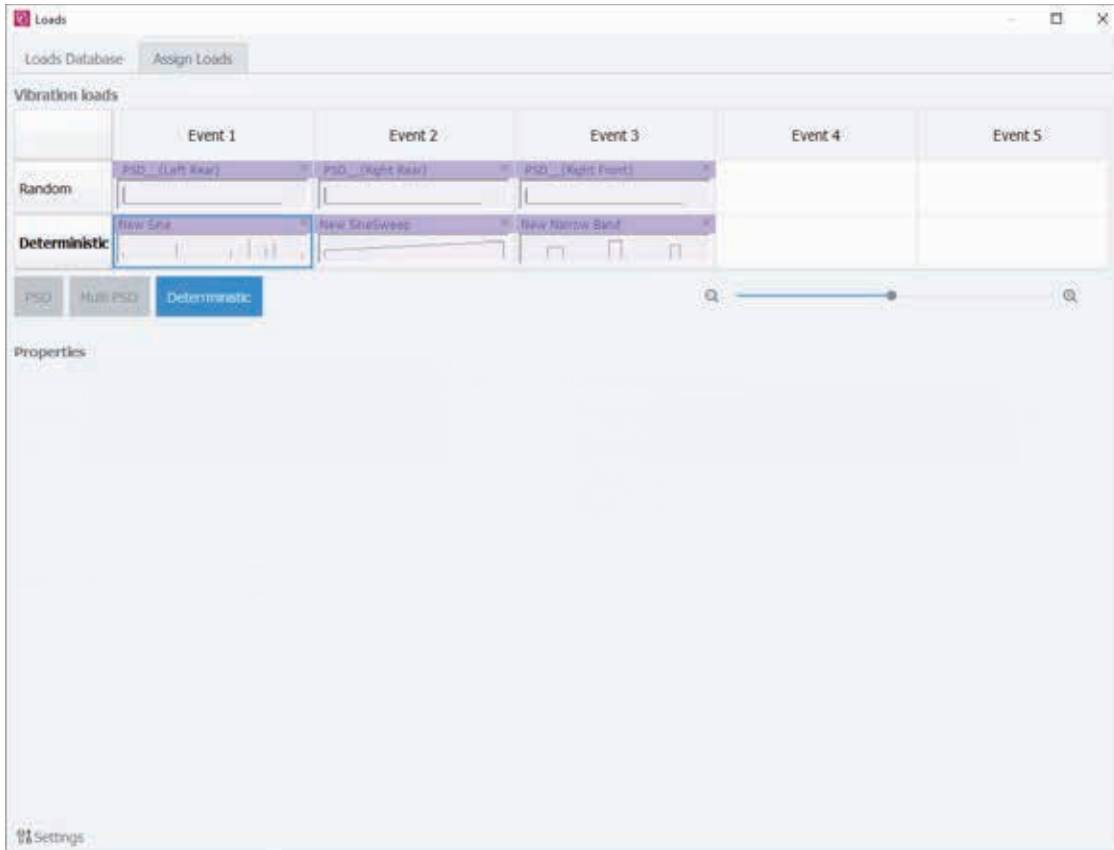
Key features



Load assignment

- Duty cycle overview.
- Set up of many parallel or serial events with just few clicks.

Key features

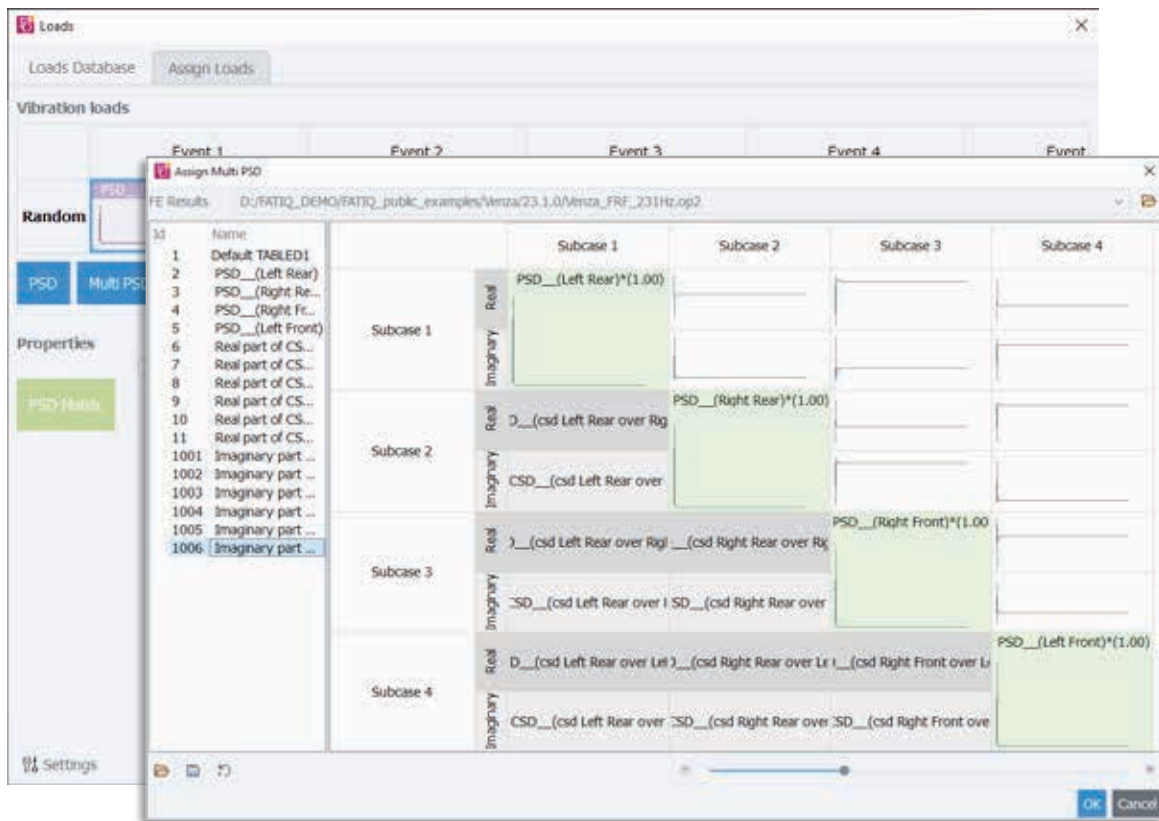


V24.0.0

Load assignment

- Combination of random with deterministic loads

Key features



Load assignment

- Intuitive set up of multiple - correlated input.

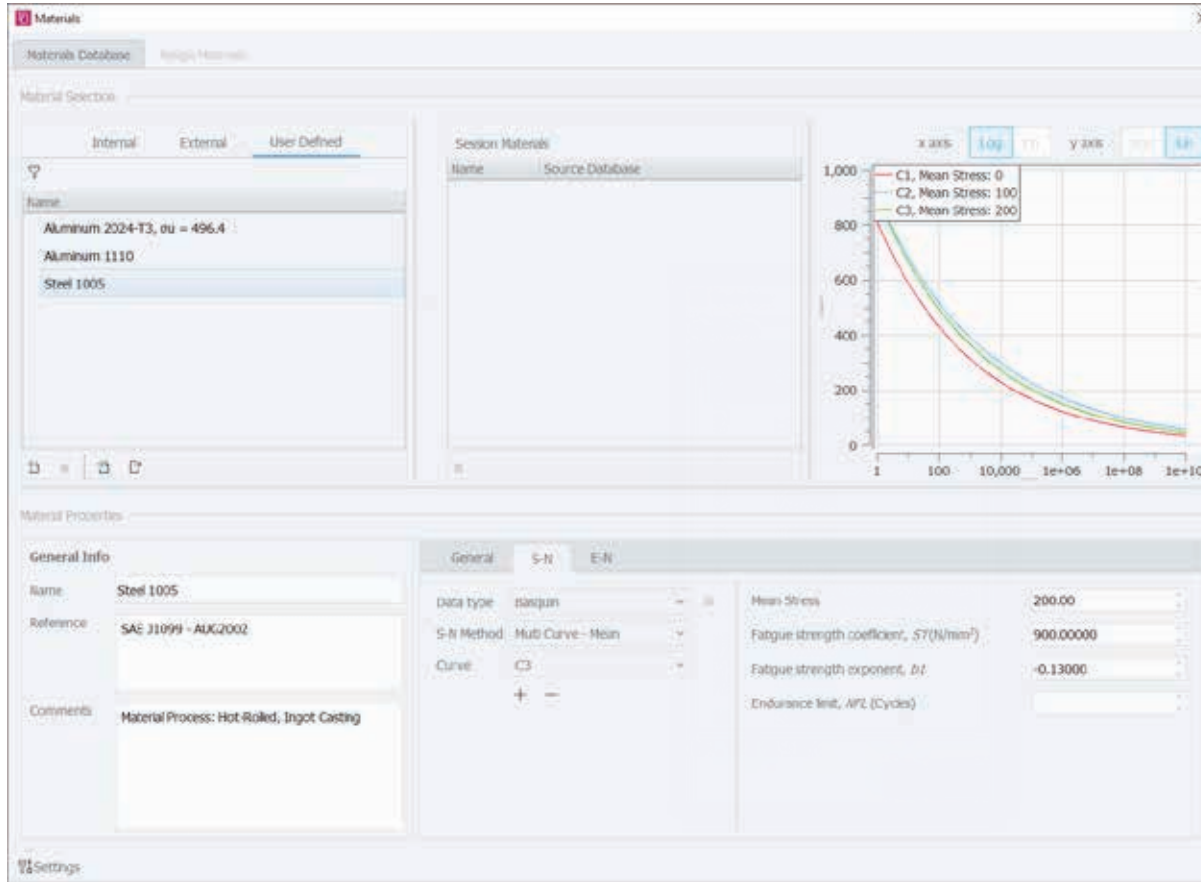
Key features

The screenshot displays the 'Materials Database' software interface. At the top, there are tabs for 'Internal', 'External', and 'User Defined'. The 'Internal' tab is highlighted with a red box. Below the tabs, a list of materials is shown, including 'Aluminum 2024-T3, $\sigma_u = 496.4$ ', 'Aluminum 1110', and 'Steel 1005'. To the right, a 'Session Materials' table is visible. On the far right, a graph shows a fatigue curve for 'C1' on a log-log scale, with stress on the y-axis (0 to 900) and cycles on the x-axis (1 to $1e+10$). Below the graph, the 'Material Properties' section is shown, with 'General Info' and 'General' tabs. The 'General Info' tab displays the material name 'Steel 1005', reference 'SAE J1099 - AUG2002', and comments 'Material Process: Hot-Rolled, Ingot Casting'. The 'General' tab shows data type 'basquin', S-N Method 'Standard', Fatigue strength coefficient S_0 (N/mm²) as 807.55453, Fatigue strength exponent n' as -0.13706, and Endurance limit N_{F2} (Cycles).

Material database

- Internal database of more than 80 fatigue materials for metals and alloys.
- Open format to read external material databases
- User defined materials

Key features



Material database

- Material data type according Basquin or MMPDS equation or as data table.
- Support of multi curve materials.

Key features

The screenshot displays the Material Database software interface. The top section is titled "Material Selection" and includes tabs for "Internal", "External", and "User Defined". Below these tabs is a list of materials: "Aluminum 2024-T3, du = 496.4", "Aluminum 1110", and "Steel 1005". The "Steel 1005" material is selected. To the right of the list is a table for "Selected Materials" with columns for "Name" and "Source Database".

The bottom section is titled "Material Properties" and is divided into "General Info" and "E-N" (E-N Method) tabs. The "General Info" tab shows the material name "Steel 1005", reference "SAE J1099 - AUX2002", and comments "Material Process: Hot Rolled, Ingot Casting". The "E-N" tab shows the following properties:

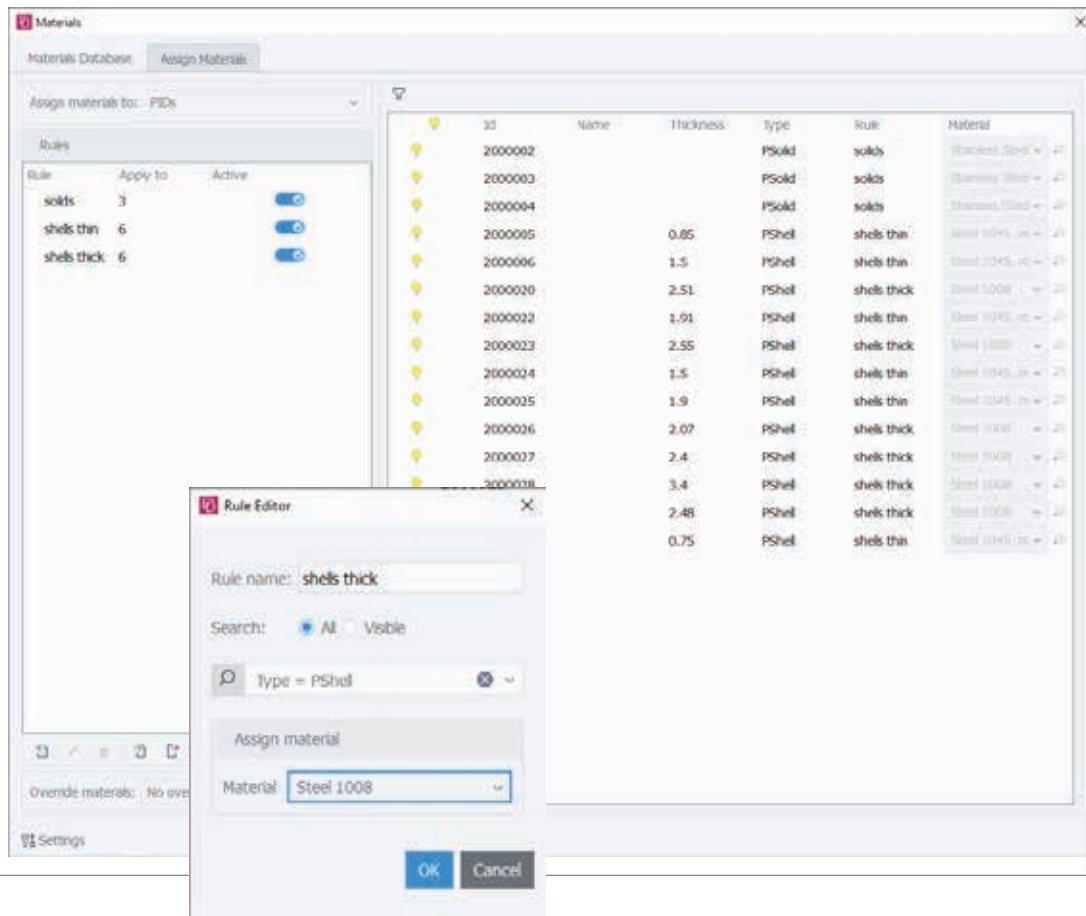
Property	Value
Fatigue strength coefficient, $S_7(1/\text{mm}^2)$	888.00000
Fatigue strength exponent, b	0.13700
Fatigue ductility coefficient, ET	0.28000
Fatigue strength exponent, c	-0.50500
Cyclic strength coefficient, K	1208.00000
Cyclic strain hardening exponent, n	0.26000
Endurance limit, $2Nf(\text{Reversal})$	

Material database

V24.0.0

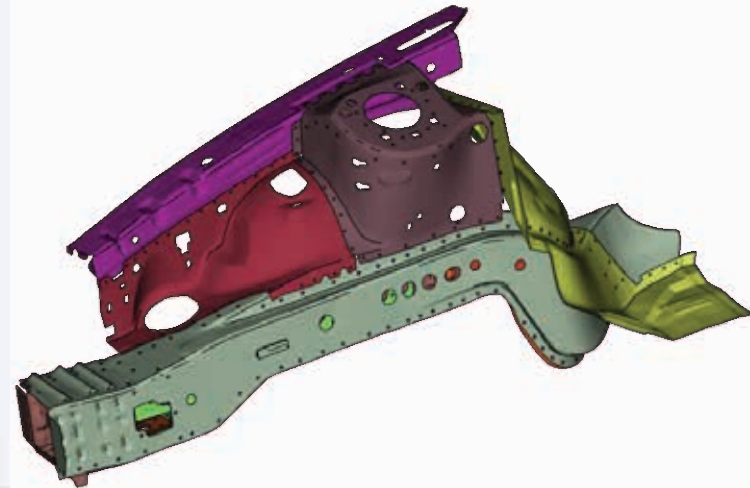
- Support of E-N properties in version 24.0.0

Key features

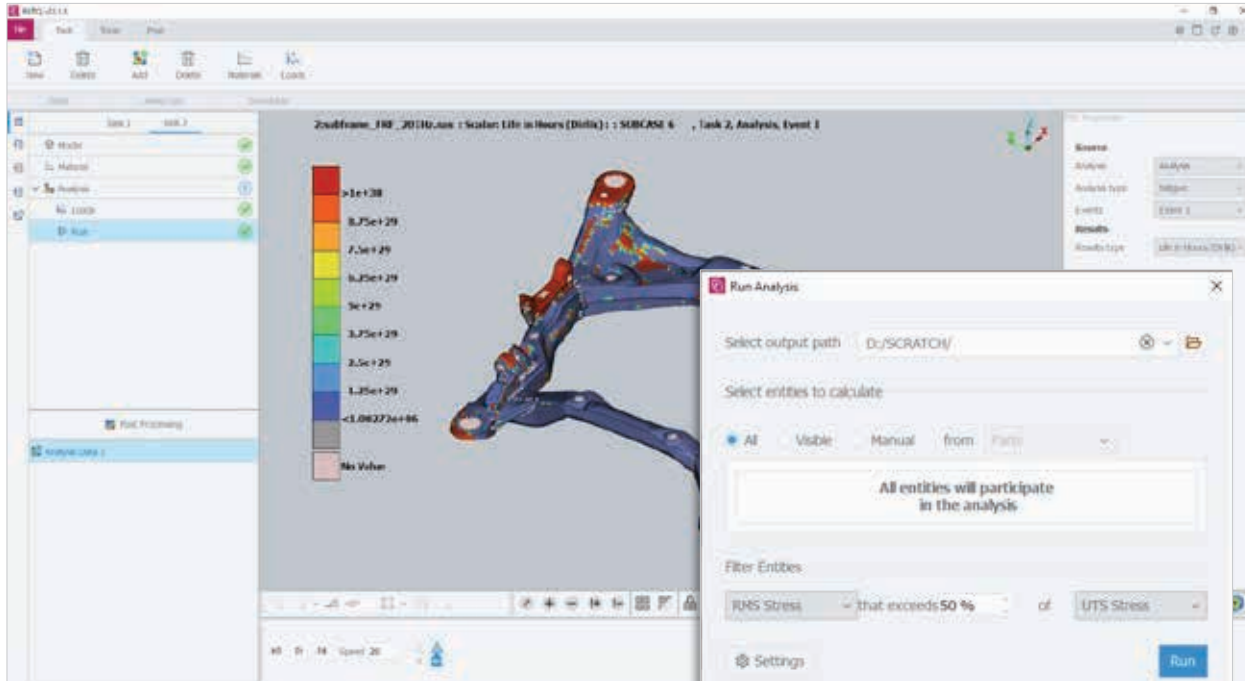


Material assignment

- Sophisticated rules for material filtering and assignment facilitates the set-up especially on large and complicated models.



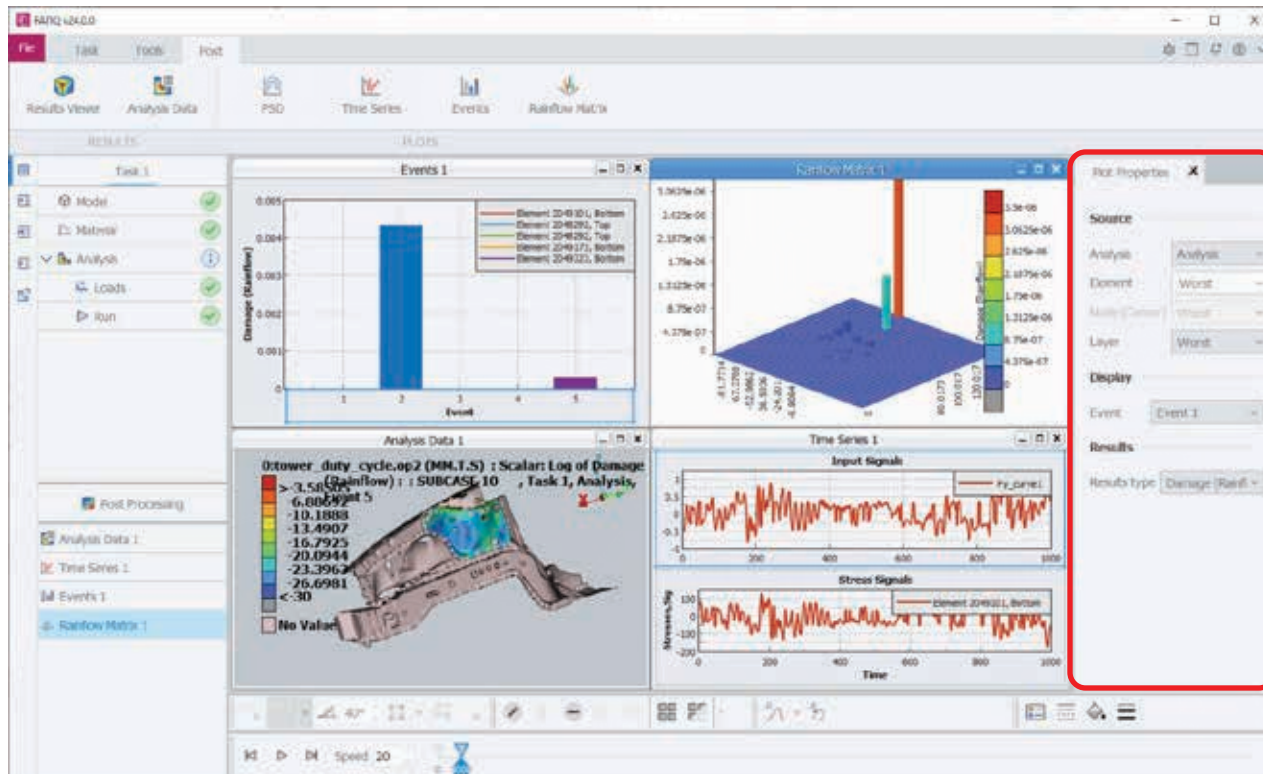
Key features



Hot spot filtering

- Filtering of hot spots to narrow analysis in critical areas.

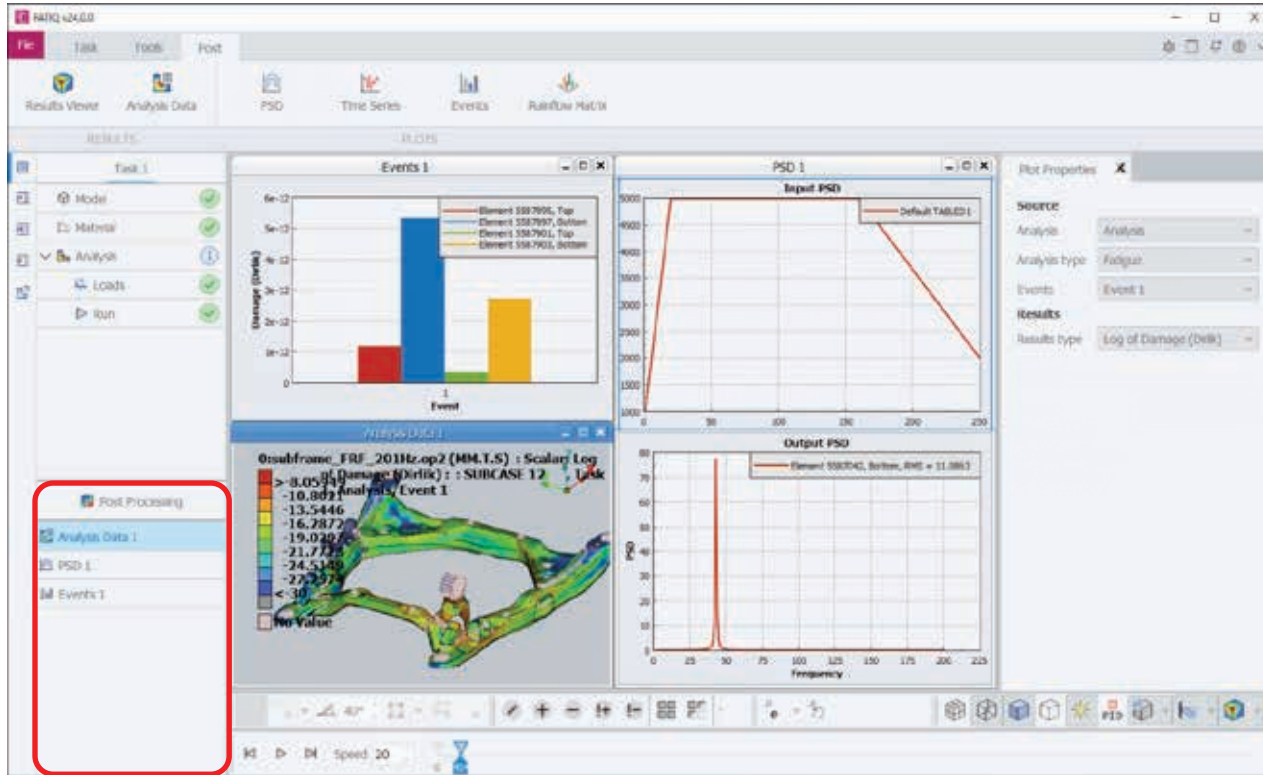
Key features



Interactive post-processing

- Dedicated plots such as, PSD plots, Event graphs, Rainflow matrices and 3D fringes.
- Interactive Properties for the selected plots

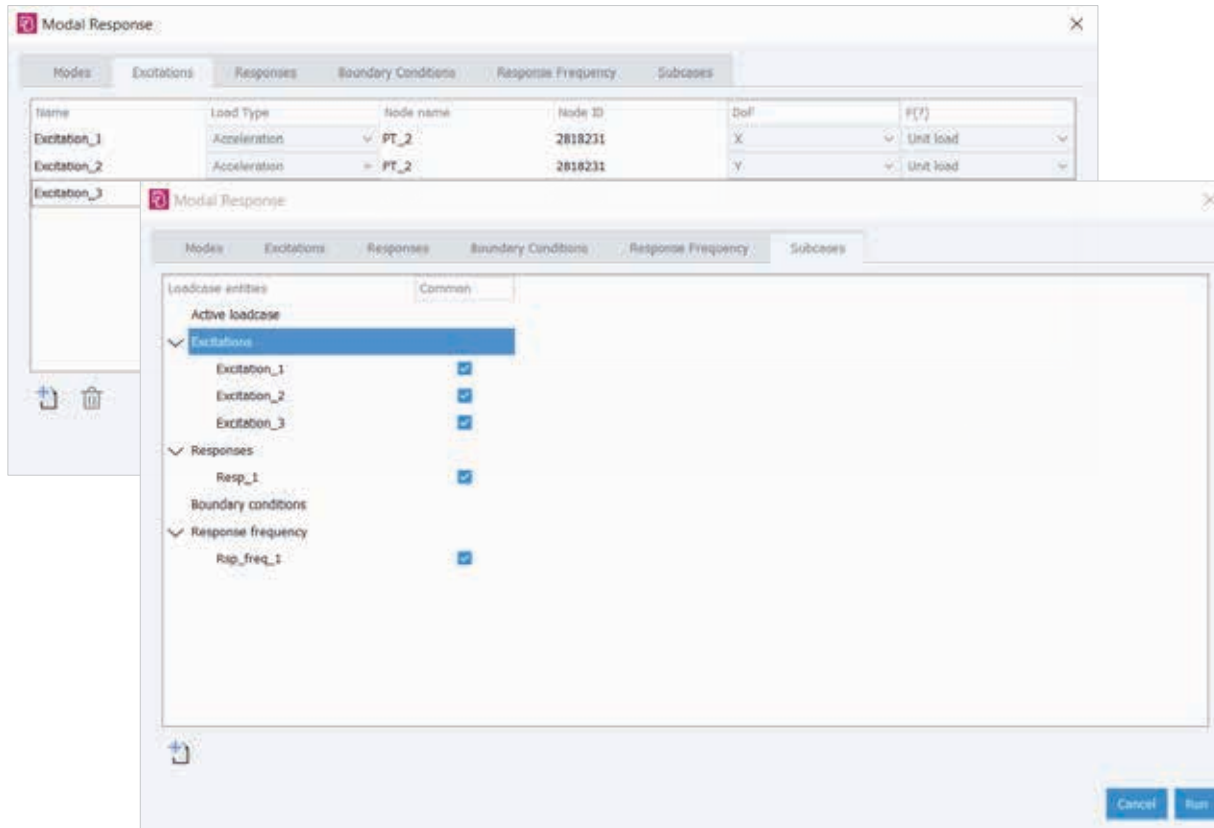
Key features



Interactive post-processing

- Dedicated plots such as, PSD plots, Event graphs, Rainflow matrices and 3D fringes.
- Easy handling and plot overview through the Post Processing Tasks

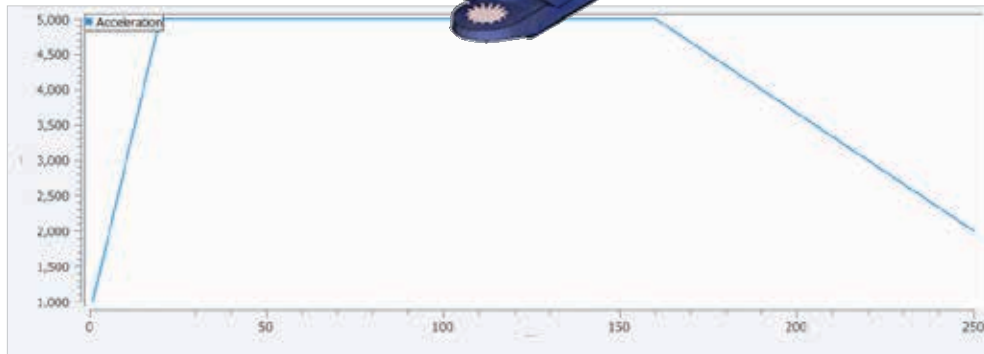
Key features



Tools

- Modal response builder enhanced tool

Performance

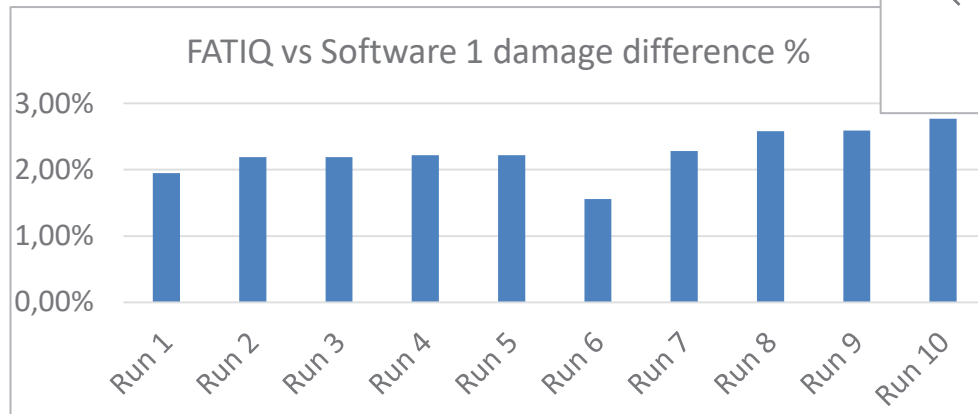
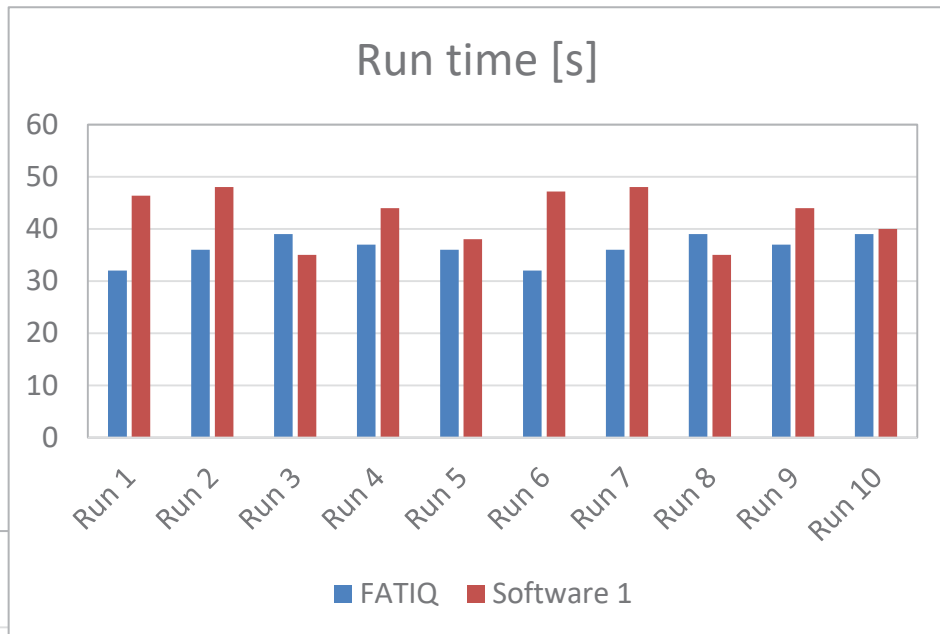


Frequency domain – PSD Load

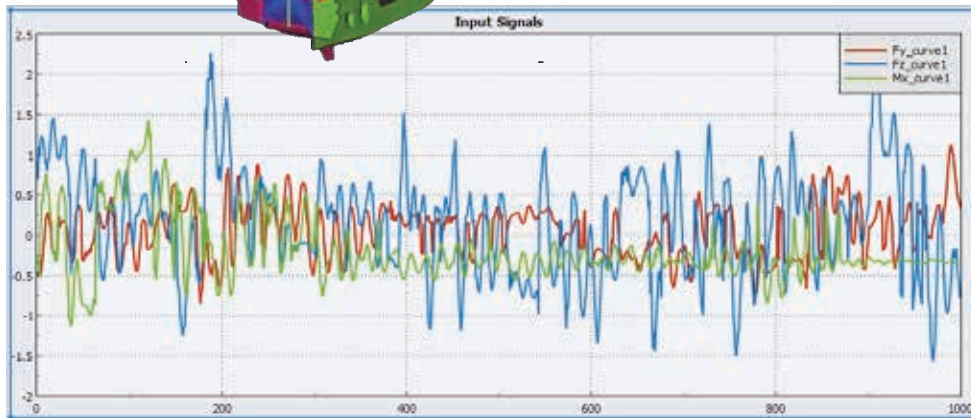
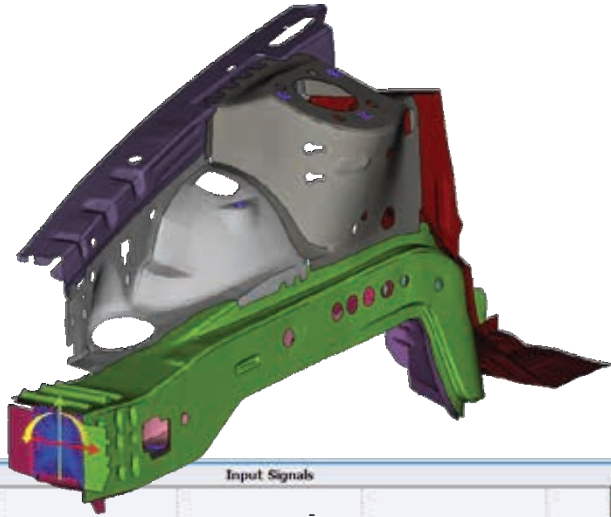
- Stress evaluation: **Von Mises**
- Fatigue life estimation method: **Dirlik**
- Solution location: **element corners**
- Artificial mean stress correction effect from equivalent static loading

Test Cases		
	Mean Stress Correction	Material Type
Run1	-	Basquin
Run 2	Goodman	Basquin
Run 3	Goodman (Only Tension)	Basquin
Run 4	Gerber	Basquin
Run 5	Gerber (Only Tension)	Basquin
Run 6	-	tabular data
Run 7	Goodman	tabular data
Run 8	Goodman (Only Tension)	tabular data
Run 9	Gerber	tabular data
Run 10	Gerber (Only Tension)	tabular data

Performance



Performance

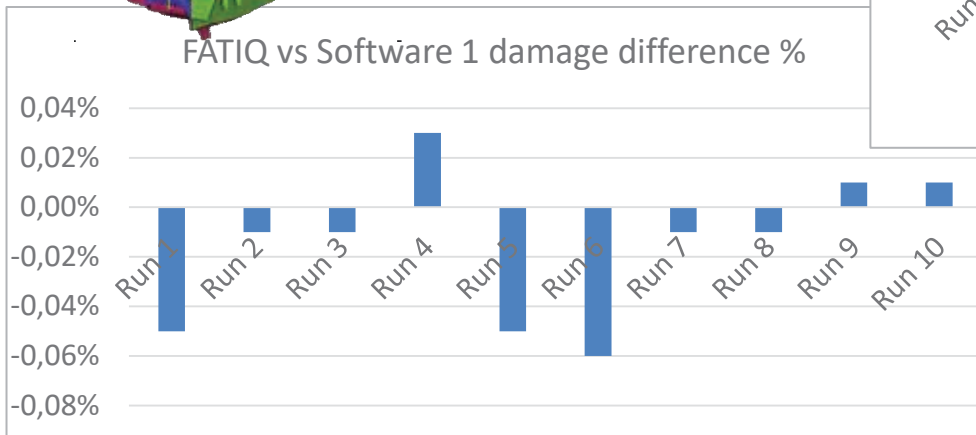
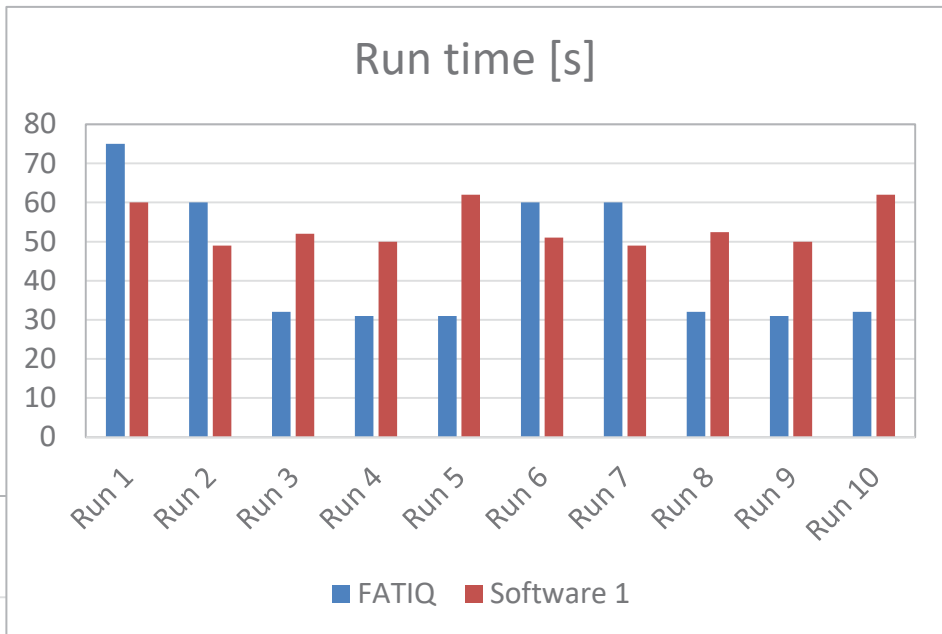


Time domain – Pseudo static

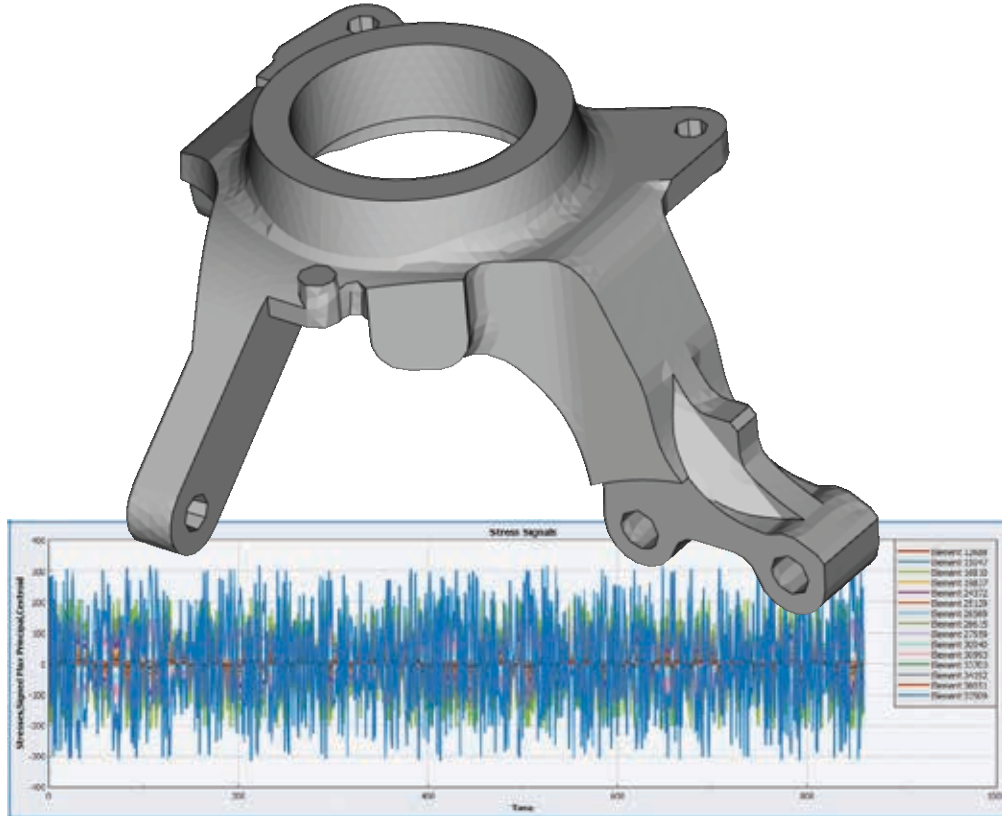
- Stress evaluation: **Signed Max Principal**
- Cycle counting: **Rainflow**
- Solution location: **element corners**

Test Cases		
	Mean Stress Correction	Material Type
Run1	-	Basquin
Run 2	Goodman	Basquin
Run 3	Goodman (Only Tension)	Basquin
Run 4	Gerber	Basquin
Run 5	Gerber (Only Tension)	Basquin
Run 6	-	tabular data
Run 7	Goodman	tabular data
Run 8	Goodman (Only Tension)	tabular data
Run 9	Gerber	tabular data
Run 10	Gerber (Only Tension)	tabular data

Performance



Performance

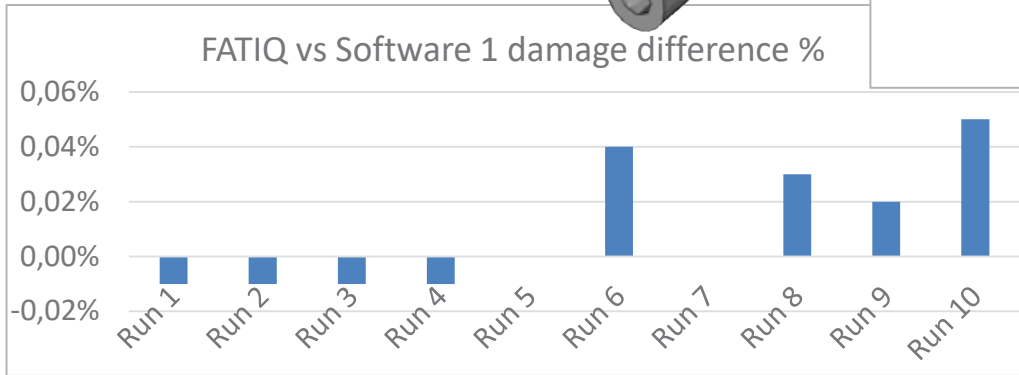
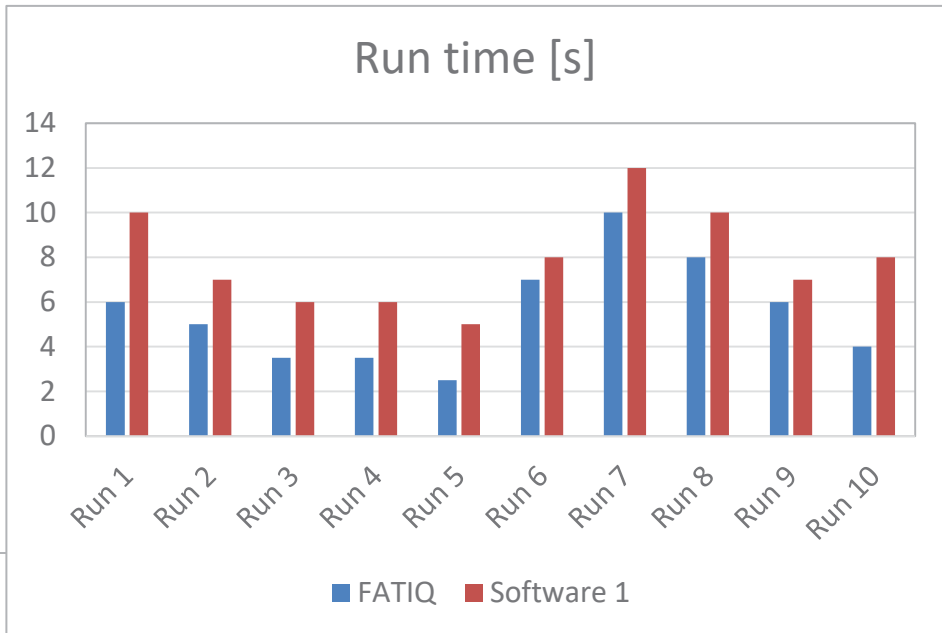
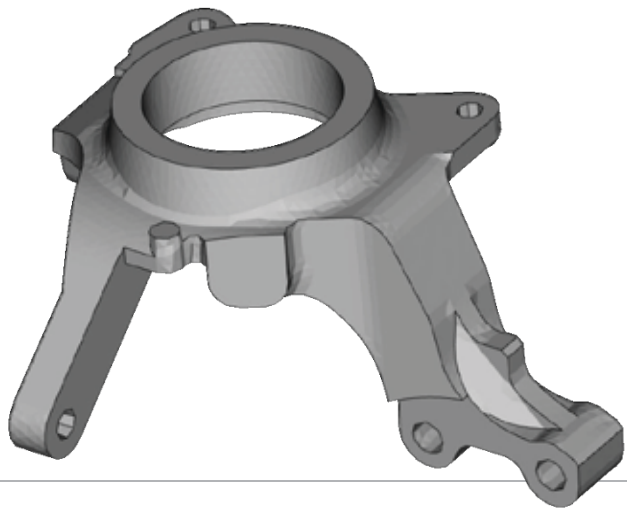


Time Domain - Transient

- Stress evaluation: **Signed Max Principal**
- Cycle counting: **Rainflow**
- Solution location: **element centroid** (15 elements)

Test Cases	Mean Stress Correction		Material Type
	Mean Stress Correction	Material Type	
Run1	-	Basquin	
Run 2	Goodman	Basquin	
Run 3	Goodman (Only Tension)	Basquin	
Run 4	Gerber	Basquin	
Run 5	Gerber (Only Tension)	Basquin	
Run 6	-	tabular data	
Run 7	Goodman	tabular data	
Run 8	Goodman (Only Tension)	tabular data	
Run 9	Gerber	tabular data	
Run 10	Gerber (Only Tension)	tabular data	

Performance



Future development

1 Multiaxial fatigue analysis

2 Spot-weld and seam-weld fatigue modeling

3 Non-Gaussian system

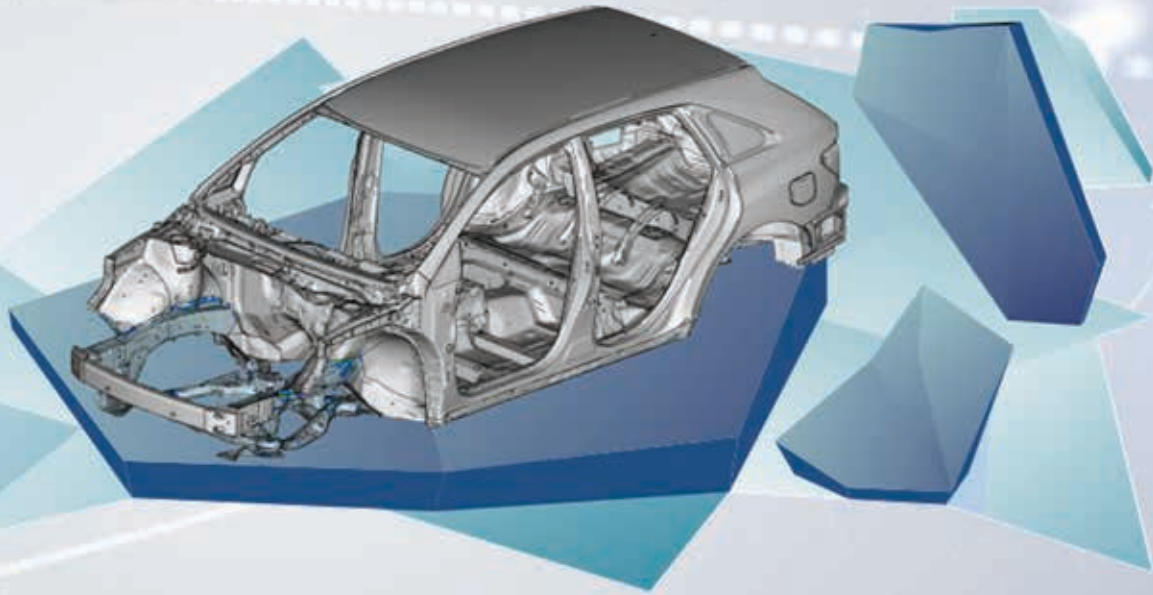
4 Signal processing

5 Stress gradient effect

6 Connect to optimization

7 Connect to data management

FATIQ
LIFE PREDICTED



Thursday, 14:00, Demo Session 6E, Venus I

Key features and use cases of FATIQ

Christos Tegos

BETA CAE Systems



Stay connected