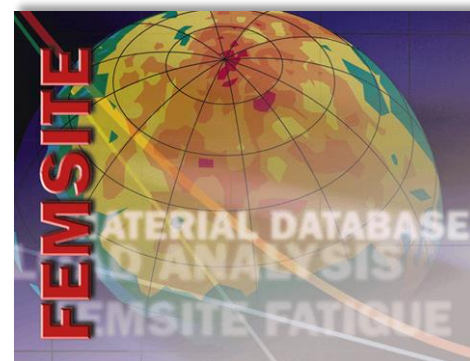


# FEMSITE 4.8

## Pushing the Limits

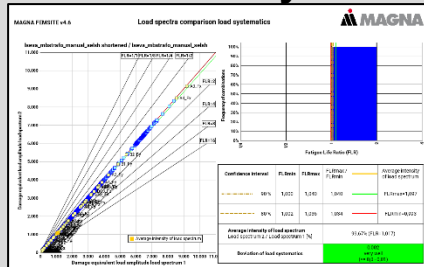
Introduction of  
Modules and Functionalities



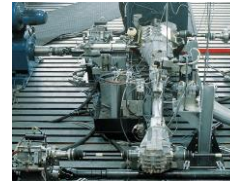
# FEMSITE

a commercial software product  
of MAGNA

## Load Analysis



FEMSITE is a workflow oriented software product which covers the complete structure durability process in the automotive development. More than 20 years of development and validation experience are concentrated in FEMSITE.

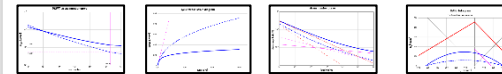


## Online classification

Analysis and preparation of load spectra from measurement or MBS simulation for simulation and test rigs

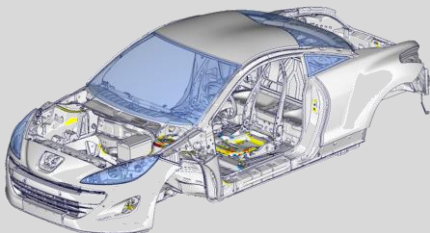
[illegible]

## Joins database



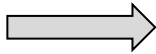
## Material database

# Fatigue

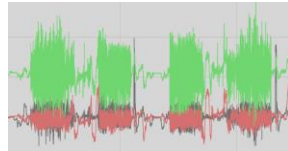


Design, analysis and optimization of components and complete vehicles based on linear or nonlinear simulation results combined with measured or simulated load time histories regarding → Stiffness, Strength and Fatigue

# Module FEMSITE Load Analysis



Virtual and / or  
physical road load  
data



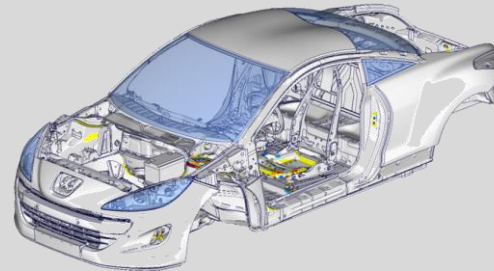
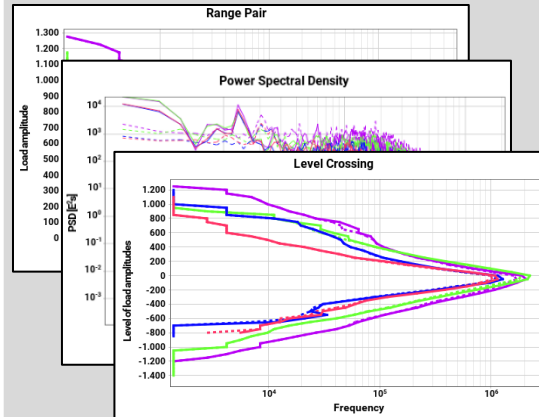
Analysis of measured  
or calculated load  
spectra.

Supports a variety of  
established data formats,  
as for example:

Diadem/Diadago, RPCIII,  
RigSys, DASyLab,

Adams, DADS,  
ASCII, TDM, etc.

## FEMSITE



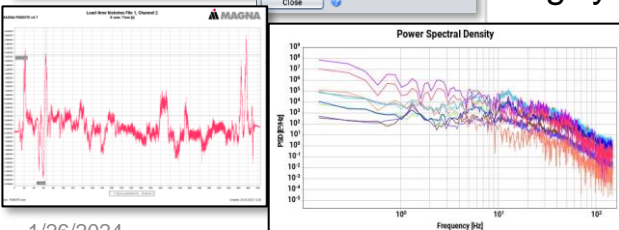
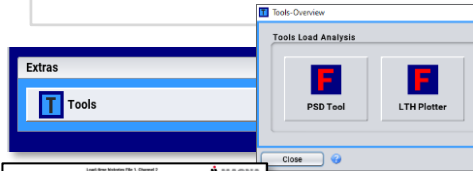
Large number of  
evaluations available such  
as PSD, rainflow matrices,  
statistic values,...

Main functions are:

- load spectra comparison
- selective shortening
- MBS/FEM interface
- signal editing
- representative lap
- shaker program generation
- block program generation

Transformed and / or  
selective shortened load  
time histories will be used  
on test rigs or for  
simulation

USP

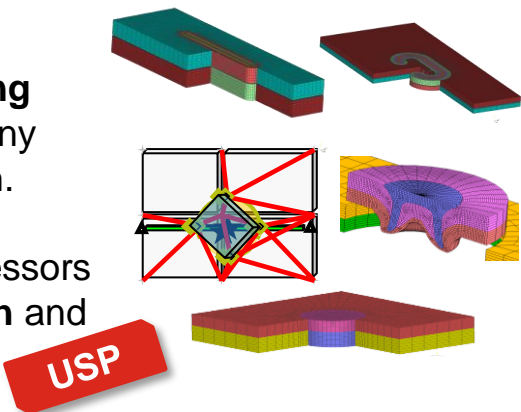




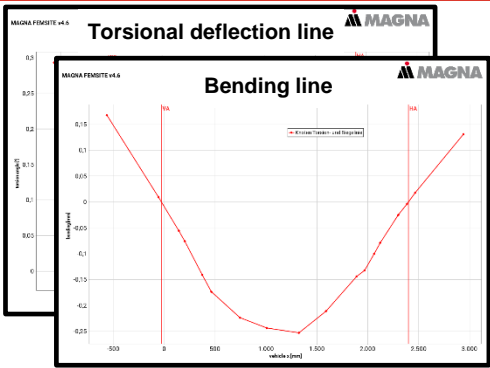
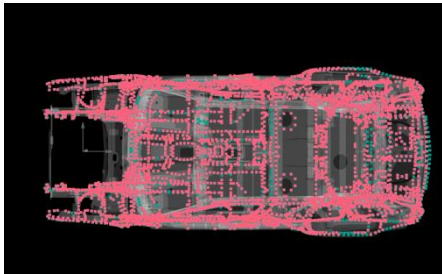
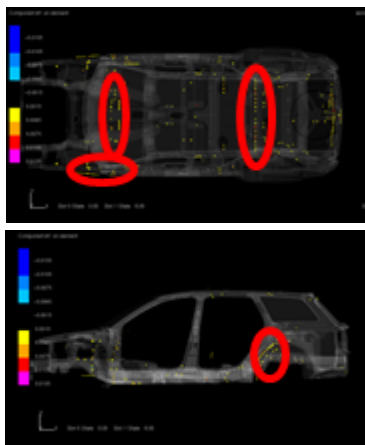
# Module FEMSITE Fatigue – Part 1



Node independent generation of joining technique without any modification of mesh. Also available as interface in preprocessors **Medina**, **Hypermesh** and **ANSA**



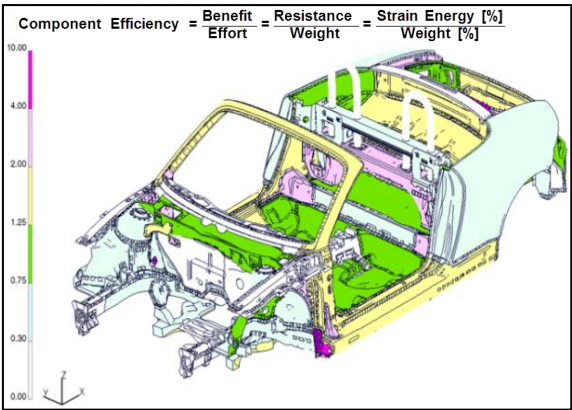
Identification of **stress conditions** of **spotwelds**, areas with **high deformation** in a **flange** based on several load cases in early project phases. **optimization** regarding number and position.



Global characteristics of a car body such as **torsion**, **bending stiffness** and other evaluations available.

Component related evaluations to identify parts which have a large influence on a certain load case.

Variante 1		Variante 2		Variante 3		Variante 4		Variante 5	
Lastfall		Torsion		Biegung		Torsion		Biegung	
Erstelldatum		21. Nov. 12		21. Nov. 12		21. Nov. 12		21. Nov. 12	
Netz	Bezeichnung	Spannung [N/mm²]	Dicke [mm]	Elementanzahl	Masse [kg]	Verformungsarbeit [% von Auswertung]	Nutzungs-zahl [-]		
		1	2	1	2	1	2	1	2
1105	HALTERBOCK HALFSIR. 1H	25.93	2.77	1.75	336	336	0.421	0.569	0.014
1110	SCHWELER AUSSEN 1H	55.63	11.94	1.75	1.75	3154	3154	0.009	0.009
1145	SCHWELER AUSSEN 1H	55.66	12.23	1.75	1.75	3142	3142	0.002	0.002
115	BECKENBUCHSEN 1H	3.59	1.87	1.80	1.60	246	246	0.339	0.339
1180	SITZQUERTRAEGER 1H	29.63	14.12	0.70	0.70	2260	2260	1.953	1.953
1185	SITZQUERTRAEGER 1H	39.01	12.51	0.70	0.70	2242	2242	1.954	1.954
120	LTR VO TEIL 1 H	15.59	0.30	2.00	2.00	487	487	0.073	0.073
1205	VST FUHRUNGSSCH VO	4.41	63.05	2.00	2.00	256	256	0.341	0.341
1215	VST FUHRUNGSSCH 1H	5.91	31.27	2.00	2.00	176	176	0.359	0.359
1240	ABSCHLUSSTIEG TUNNELBL. 1H	53.06	8.07	1.00	1.00	999	999	1.245	1.245
125	LTR VO TEIL 1 H	5.87	0.40	2.00	2.00	483	483	0.087	0.087
1250	ABSCHLUSSTIEG TUNNELBL. 1H	44.84	38.29	1.00	1.00	998	998	1.242	1.242
1275	VST FUHRUNGSSCH VO	15.15	35.42	1.25	1.25	1498	1498	1.308	1.308
1290	ZWISCHENSTIEG LTR 1H	25.00	15.80	1.75	1.75	330	330	0.432	0.432



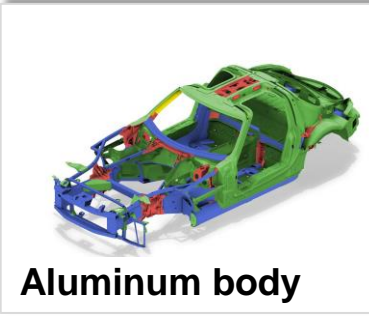
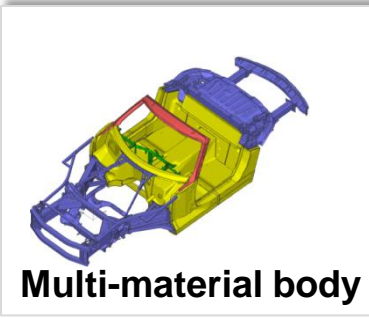
MAGNA FEMSITE v4.1 CarBody - PlotEl's

Element ID	Change in length [mm]
front_door_left	
Load Case 100, Group 401	
131	0,184937
132	-0,150879
front_door_left	
Load Case 200, Group 401	
131	-0,015503
132	-0,033203

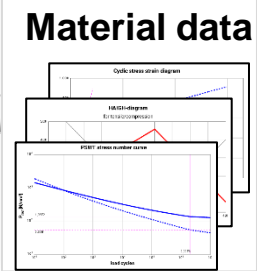
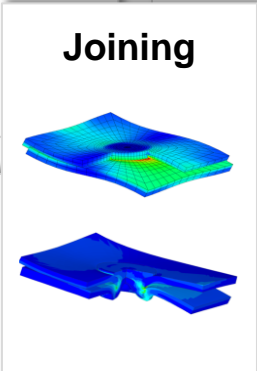
v49: Ecological footprint

Different input and output interfaces available:

- **Nastran:** op2, Bulk Data
- **Patran:** Neutral file format
- **Abaqus:** odb
- **Medina:** bif / bof
- **Universal** file format



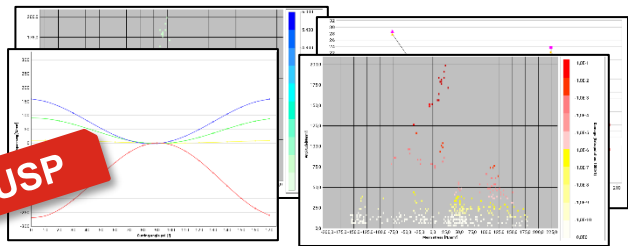
USP



USP

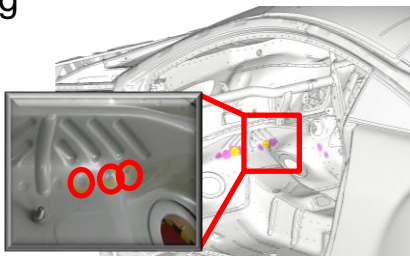
Large amount of detailed evaluations to **analyze** the local behavior of **critical positions for complete load spectra**

USP



Damage / safety calculation for single parts or large complete vehicles for **basic material** and joining techniques like **spotwelds**, **self piercing rivets**, bondings and seamwelds regarding **complete load spectra**

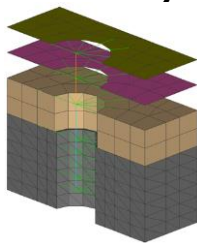
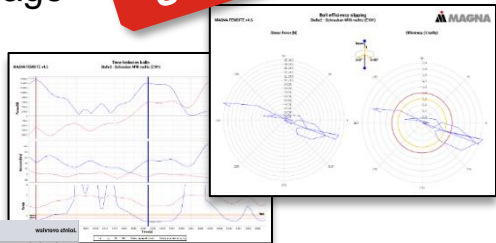
**Damage calculation of composite materials** in longitudinal, cross direction and for shear-stress for each composite ply



**Identification of critical load cases:** systematic detection of stress conditions which cause significant damage

USP

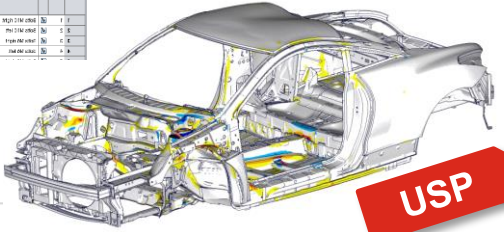
**Simulation for bolts: Safety against slipping and safety against breakage with detailed evaluation**



**Joints database**

Joint ID	Material	Geometry	Load Case	Result
001	Steel	Spotweld	Static	OK
002	Aluminum	Spotweld	Static	OK
003	Steel	Spotweld	Dynamic	OK
004	Aluminum	Spotweld	Dynamic	OK
005	Steel	Spotweld	Dynamic	OK
006	Aluminum	Spotweld	Dynamic	OK
007	Steel	Spotweld	Dynamic	OK
008	Aluminum	Spotweld	Dynamic	OK
009	Steel	Spotweld	Dynamic	OK
010	Aluminum	Spotweld	Dynamic	OK

**Animation sequence of the load spectra to analyze local stress conditions**



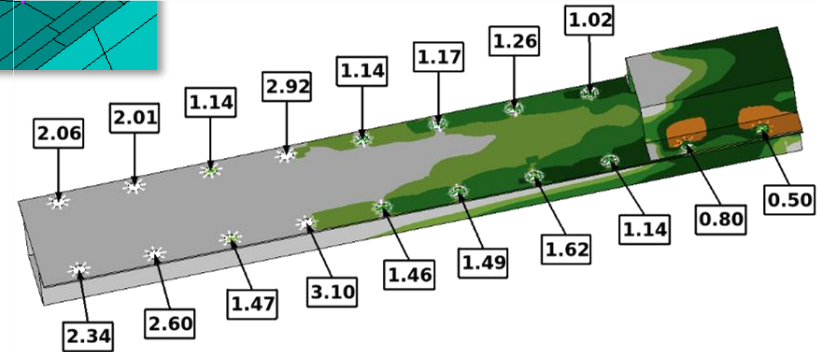
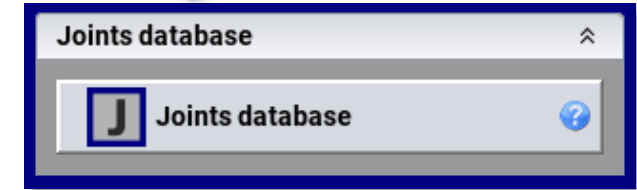
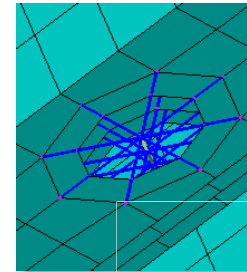
USP

Damages calculation based on

- Quasistatic
- Transient modal
- Transient
- Frequency response FE results!


# Module FEMSITE Fatigue – Bolt safety calculation

- FEMSITE supports efficient **bolt safety calculations** (safety against **slipping** & safety against **overload breakage**) in time domain
- Bolt types are managed in the central **FEMSITE Joints database**
- Bolts can be easily defined in preprocessor Ansa.
- **Export** of the results for common **postprocessors** is available
- **Special detailed evaluations** can be performed in FEMSITE
  - Bolt evaluation table
  - Time-history plots of bolt forces, moments and safety values
  - Bolt efficiency slipping
- **Recalculation of the bolts** allows the user to modify bolt parameters and quickly rerun the bolt calculation without FE- solver
- **Basic load cases bolts** allows the user to directly study basic load cases from an FE-calculation

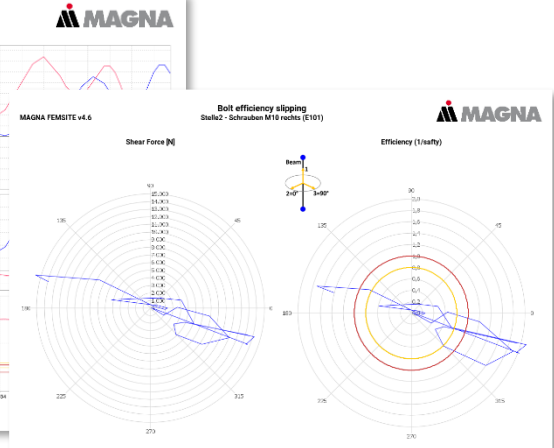
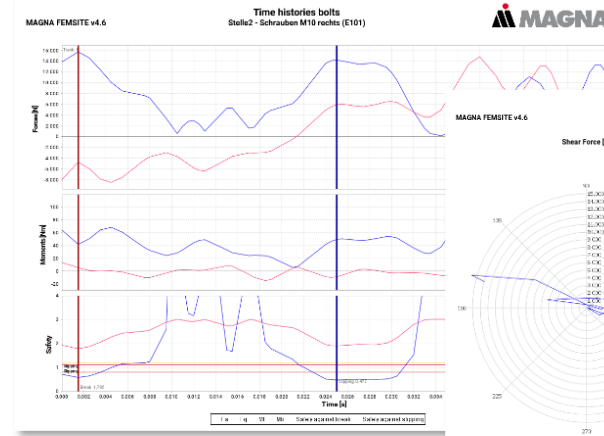


MAGNA FEMSITE v4.6

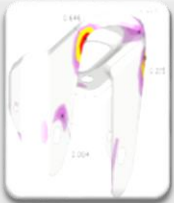
**Bolt evaluation table**



General			Input data											Result data slipping					Result data break				
No	Group	Bolt	Beam ID	d [mm]	P [mm]	Rm [MPa]	Fm [N]	Alpha	Fz [N]	Phi	Friction at interface	qf	lk [mm]	Crit. LC	Crit. Time [s]	Fa [N]	Fg [N]	Safety against	Crit. LC	Crit. Time [s]	Fa [N]	Fg [N]	Safety against
1	1	1	101	10	1.50	1040	44500	1.40	4450	0.25	0.15	1.97	3.80	100	0.0250	5922	14195	0.40	100	0.0015	-4721	15716	0.51
2	1	2	111	10	1.50	1040	44500	1.40	4450	0.25	0.15	1.97	3.80	200	0.0240	10935	9853	0.37	100	0.0380	-14806	13071	0.80
3	2	1	201	10	1.50	1040	44500	1.40	4450	0.25	0.15	1.97	3.80	200	0.0380	6959	17015	0.39	200	0.0380	6959	17015	1.44

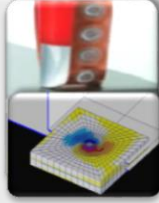


# FEMSITE V4.8: New Features



## Fatigue / Safety Analysis

- Safety against fatigue fracture
- Acceleration of safety calculation
- Averaging of stresses only for elements with corner stresses
- Evaluation of relative Minima/Maxima – New color highlighting



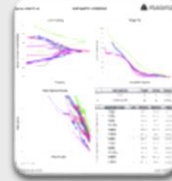
## Joining / Tools

- Extension of LTH plotter for PSD diagrams and statistics
- Adjust the stiffness values of spotwelds if the diameter is smaller than DIN
- Editing a bolt: the dependencies to other parameters are considered
- Check of spotweld position
- Adaptations during generation when a PID is contained in several parts



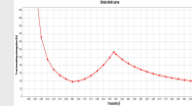
## Structure

- Improved handling of variables for automatic evaluations in Pre-Module
- CarBody + Fatigue Multiaxial: Reading of Nastran bulk data files
- Send diagnostic information
- Pack FEMSITE job file with all dependencies into zip file
- Search + replace
- Optimization of memory usage
- Writing out a FEMSITE PSD csv file



## FEMSITE Load Analysis

- Block program generation from load spectrum for chassis and powertrain
- Tool for creating Shaker test programs
- Support of load spectra with more than 2,1 billion time steps
- Support virtual iteration of excitation signals (concept)
- MBS-transformation: Automatic assignment of the load types based on the units
- Load spectra analysis for the chassis: calculation of the distance based on the wheel speeds
- Online classification: remove individual tracks from the evaluation,



## Material Database

- Export non-linear characteristics to Nastran
- Extension Triaxiality + structural damping
- All specifications for materials written into the solver deck
- Encrypted material files: survival probability and range of dispersion are now visible



## Workflow ANSA / META

- Critical bolt forces based on Abaqus odb files can now be displayed



## Interfaces

- ABAQUS 2022 is supported now
- Export of Sets in Medina bif format
- Critical bolt forces can be exported to Abaqus
- Prototype HDF5 export based on Animator a4db format
- Concept HDF5 import for Permas (result data only)



# Five reasons to develop structure and durability with FEMSITE

- **FEMSITE** is a workflow oriented software which covers the complete development process for automotive industry including **stiffness, strength and durability** **USP**
- **FEMSITE Load Analysis** for processing and validation of **load spectra**
- **FEMSITE** can handle very **large models** (~10,000,000 elements) with **full joining technique** for complete load spectra. Very short calculation time due to **DMP-parallelization** and **intelligent filtering of elements** and/or cutting planes **USP**
- **FEMSITE** is best in class regarding the **cost / functionality** ratio
- **FEMSITE** has been developed and validated in many **project applications** across the **OEMs** for more than **25 years**

## Engineering references







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