winLIFE capabilities

Overview of Modules

Property	Short description	Details	Limitations	remarks
winLIFE FKM QUICKCHECK	*Static prove,* *Fatigue prove:* Using FKM-guideline and advanced procedures for welded and non-welded structures with local stresses coming from FEA.	Static, fatigue and endurance limit prove according to FKM-guideline for the point of prove. Extensions to FKM: Finding the critical point as the prove point by analysing all nodes on the surface. A worst case analysis is done to find the critical stress combination and for this the utilisation ratio is predicted.	Only for local stresses not for nominal stresses	Static and fatigue prove strongly according FKM-guideline for the prove point. Search the prove point out of all surface nodes using powerfull methodes extending FKM guideline.
winLIFE BASIC	Basic fatigue analysis for proportional load case	Powerful analysis according to Nominal Stress Method, local elastic stress, local strain approach. Project management system, databases available	Only 1 loading	This module is prerequisite for the use of all other winLIFE modules with exception to QUICK CHECK.
winLIFE MULTIAXIAL	Multiaxial fatigue: critical plane approach	Up to 200 loadings can be used. Critical plane approach for multiaxial cases,a) static and b) modal superposition c) nonlinear extensions, Weldings can analysed by several procedures.	Max. 200 loadings	This module is needed in addition to winLIFE BASIC
winLIFE MULTIAXIAL MULTICORE	As winLIFE Multiaxial but with optimal use of all processor cores	Simultaneous calculation because the nodes to be calculated are divided between several cores. Calculation speed increased 4x with 8 cores, 2.9x with 4 cores		20% price increase over winLIFE Multiaxial
winLIFE CRACKGROWTH	Crack Propagation using Nominal Stresses	Calculating Crack Growth in Mode I according to Paris and Erdogan Ratwani	Until now only for Nominal Stresses	This module is needed in addition to winLIFE BASIC
winLIFE GEARWHEEL&BEARING	Fatigue analysis: Calculation for component parts necessary for calculating gearwheels and bearings. It is recommended to use it together with the ZAR-software of HEXAGON	User must know characteristics of gearwheels. Use of HEXAGON Software recommended.		This module is needed in addition to winLIFE BASIC
VIEWER4WINLIFE	Graphical representation of results FEA (stress and strain) and fatigue within winLIFE	The user can show the FEA results like stress and strain coming from ANSYS, Nx, NASTRAN, FEMAP, ABAQUS and winLIFE results like damage sum, number of cycles until failure, number of repetitions until failure, different kinds of equivalent amplitudes, and safety against endurance limit.		This module is needed in addition to winLIFE BASIC
winLIFE RANDOM FATIGUE	Fatigue calculation based on PSD results	Results of node stresses given as PSD are used for fatigue analysis	Only for linear, ergodic and stationary process	This module is needed in addition to winLIFE BASIC
winLIFE STATISTIC	Getting relations between single parameters and fatigue life in between a parameter range	Creating combinations of parameters (DOE), automatic calculation of variants, multiple nonlinear regression analysis, and graphical presentation of results. Investigating Sensitivity and robustness!		

Details

Property	*Short description*	*Details*	*Limitations*	*remarks*
User interface	Windows standard	- Each project in one window allows parallel working projects - Masks for input/output with detailed description the parameters - Data tree for fast access for power users	Windows 7 or later	Max. 2000 projects simultaneously
Database for life data	Database for stress-life curves (S-N), FKM Database for strain life curves (e-N)	ACCESS database: For single user installation / (simple to install) SQL-Server: For multi user installation / (complex installation process)		You can use SQL-server database for a single-user version too but the installation procedure is more complex.
32 Bit Version	Sufficient for most models	The address space of 32 bit is a limit but only very huge models are affected. In such a case the use of 64 bit is recommended.		
64 Bit Version	Recommended for very large models	The addressable space is much larger than 32 Bit.		If MS-Office 32 bit is used on a 64 bit system problems result. In this case the 32 bit version should be used.
Documentation	Printable version (PDF) and online-version			The pdf-file (1000 pages) can be printed by the user. We can deliver it if wished (additional costs)
Installations	Single-user with hardlock Network-license with hardlock. Can be used on computers according to the number of licences purchased Terminal server with hardlock	1 hardlock each computer 1 hardlock on a server, installations on separate computers winLIFE works only on the terminal server where the hardlock is located. No installation on the client computer necessary	Recommended for multiple licenses, because only one has to be updated	
Training	Video examples in the internet and on the winLIFE-CD	http://www.stz-verkehr.de/tutorial_de.htm	There are 31 video-examples showing the use of winLIFE	
Seminars	5 different one day seminar types. One time a year near Ulm in English, 3 times in German.	Dates, program & registration forms http://www.stz-verkehr.de/e_semi.htm	English seminar on request	English seminars available worldwide on request in your company
winLIFE used in following fields	Automotive Civil Engineering Wind turbines Ship Education (Universities)		Reductions available for Universities (teaching purposes)	

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Type of analysis	Using just one FE load case	Based on **one** FE-load case the node stresses are scaled with the aid of the load time function and calculated according to the notch stress concept or local approach.	One load case possible	
	FEA-Superposition of several FE-Load cases (max. 1000)	FE unit load cases scaled with the aid of (measured) load time functions and superposition of elastic stress tensors to calculate the stress and damage accumulation in the cutting plane.	Max. 200 static FEA-Load cases possible.	
	Transient analysis from FEA or MBS	Stress tensor time history is read from FEA and used for fatigue analysis.	Limited to max. 20 000 nodes, no time limit	Dynamic and/or non-linear problems can be calculated
	Using measured (strain) data	Flexible import of nearly all kinds of strain gauge rosettes data		
	Stand alone operation without FEA/MBS connection	"Classic" fatigue calculation for one point without FEA using engineering mechanics		
FEA software which can be used with winLIFE	ABAQUS ADINA ANSYS FEMAP (NxNASTRAN NEiNASTRAN) MEDINA Recurdyn	Data import is possible in the following ways: 1.) Direct data import (native data) from FEA are available for: - ANSYS, OP2 (Nx, NASTRAN, et., ABAQUS) - 2.) Additional tools for weldings using macros are shipped for FEMAP, ANSYS 3.) Tool to import ASCII-export-files generally from FEA in table format (user competence necessary)		
Fatigue calculation methods until crack	Nominal stress: (S-N- curves, can be transformed to any failure probability), temperature influence to the S-N curve is considered for any failure probability	approaches for Miner rules: - original, elementary, according to Haibach, Liu-Zenner - Mean stress correction by S-N-curve transformation or amplitude transformation		
	Local stress: (S-N-curves, can be transformed to any failure probability), temperature influence to the S-N curve is considered for any failure probability	Equivalent stress definition: - normal stress - Tresca - mod. v. Mises - Findley		
	Local strain approach (e-N- curves) 50% failure probability	Damage parameters: Smith Watson Topper, Bergmann, Socie, Fatemie Socie Neuber: original, according to Sonsino		Interactive animation of stress strain path and Neuber rule for education
Crack propagation analysis	LEBM (linear elastic fracture mechanics) with nominal stresses for Mode 1	Paris equation, Erdogan-Ratwani		

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Loading can defined by	load time history (max 200 in multiaxial case for each project)	Single load step can be entered manually ,Sinus-Load-Generator File containing history (got from measurement)		
	Load spectrum	Spectrum can be entered manually Spectrum generator for often used spectra available.		
	Rainflow-Matrix	Different procedures to consider the residuum	Maximum 500 classes	
	Torque and speed history (gear wheel) load and speed history (bearing)	Residence time count is performed		
	Strain measurements	Rosette data of any required configuration can be entered (ASCII-format necessary)		
	Power Spectral Density	The PSD of acceleration acts on the structure and the response spectra of the stresses on each node need to be calculated by FEA. A damage equivalent load spectrum is created for each node. And this is used for the damage accumulation.	The user must create a result file from his FEAA according to the given specification in winLIFE.	The user must have an understanding of the theory behind the procedure to get appropriated results.
Load split for rotating components	The measured load is divided into several split loads for each rotation.	The load split enables the fatigue calculation of rotating parts by superposition of unit load cases.		
Classification methods	Rainflow Range Mean Pair count / Range pair count Residence time count (Gearwheel, Bearing) Level crossing	Different procedures to consider the residuum available Range Mean Pair count with or without mean influence		
Creating S-N-curves from static material data	Hück, Trainer, Schütz			
	Haibach			
	FKM	Full FKM- database is available		
	GL (ship building)			
	GL (wind energy)			
Creating e-N-curves from static material data	UML	Uniform Material Law		
	Universal slopes / Modified universal slopes			
User Database	Component S-N curves created by user are saved in a user database	Database can be ACCESS or SQL-server database. Can be accessed by several users in network.		
Material database	Full FKM database and more than 1400 strain life data are shipped with the program on CD	The user can add his own material data into the database		
Seam welds	Nominal stress (FKM)			
	Nominal stress GL (ship, wind turbines)			
	Structural concept GL (ship building), FKM, Marquis			
	R1-concept	User has to create a suitable FEA mesh and to define his S-N curve.		
	Automatic meshing for plates	Screening procedure to find hot spots, low effort needed		
Special Modules	Gearwheel	Flank and root life curve generator available.	Special parameters of the design of the wheels must be known.	Connection to Hexagon software available and recommended.
	Bearing	Calculation based on the life data of the manufacturer		
Batch Procedure	batch procedure can be used to define a calculation stream	A batch process can be simply created by the user- interface or manually by a script.		

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External call of winLIFE	You can start winLIFE from the shell or from other programs with parameters	An integration in a batch process together with other software (FEA, optimisation, driveline-simulation is possible. And helps to automate the calculation procedure especially in the case of huge structures.		
Superposition	Single projects can be superimposed	Those types of open projects which lead to the same type of classification (e.g. Rainflow, residence time count) for fatigue life calculation are proposed for superposition. It is checked automatically if the conditions are met (Number of classes, width, etc.).		
Extrapolation	An extrapolation (of one project) is possible			
Automatic calculation of the related stress gradients	The related stress gradient is calculated based on the FE-model	For each surface node the related stress gradient is calculated automatically while reading the result data form FEA. The S-N curve can be modified locally by using the related stress gradient.		Coincidences can be compensated for better than with just one single element.
Result presentation - one project		- Protocol file - Results of classification methods - Mohr`s circle for each time step - equivalent stress history for each plane - DEL (Damage Equivalent Load) - angle of 1st principal stress for each time step - relation of 1st and 2nd principal stresses - damage equivalent rectangle stress - S-N curve including load amplitude and damage - Haigh-diagram including load and damage - Rainflow-Matrix including damage - Range Mean Pair count including damage - Export file for data transfer to FEA (simple to use ASCII file) - contour plot of the stresses on the FE-model		
- Project management	Up to 2000 parallel projects Container classes	The graphs of many projects can be shown in one graphic for the comparison All projects in a container differ only in the loading-data. Changes in the container project will lead to changes in ALL projects included in the container.		
- Project generation	Automatic generation of projects for parameter analysis			

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- Load Influence Analysis	Automatic analysis of the meaning of each loading for fatigue life	Load combinations are varied and their influence to damage is calculated		
Data Manipulation	Load data can be manipulated interactively: - removing a drift, - multiplying and/ or adding a value, - removing spikes - modifying Rainflow-counts	Data correction is supported. Beside of this data manipulation of the rainflow-matrix is possible to analyse "what would happen if".		
Graphics design	The user can change all the graphics easily so that he can analyse them and use for his technical report	Layout design is supported so that no additional software for reports should be needed. Special animations for Neuter's rule, Amplitude transformation are available to help understanding the procedures.		
Export of graphics for later use	1.) Export of each graphic into the clip board 2.) Export into a *.png-file			
Report	Creation of pdf-report	User can create a selection of the elements of the report. All graphics available can be included and are automatically created in the user defined report.		