



What's new in winLIFE 4.0 2018

Continuity of the Modules

- ✓ the transfer of data between the winLIFE modules has been significantly improved. Both material and geometry data can be used by all modules without conversion. This applies in particular to the FKM modules and BASIC and MULTIAXIAL.

Data import from ANSYS, ABAQUS, Nx, MARC, Recurdyn

The data import with the help of the VIEWER4WINLIFE has been expanded and improved in the following way:

- ✓ It is now possible to read OP2 files with or without containing the geometry.
- ✓ from the MBS system Recurdyn, the modal coordinates and stresses can now also be read in.
- ✓ Many small bugfixes during import-from Ansys and ABAQUS.
- ✓ Marc files can be read with the help of the OP2 files.
- ✓ The VIEWER4WINLIFE now also has an extended functionality in the FKM module. For example, the visualized selection of the nodes/elements to be calculated.

VIEWER4WINLIFE

- ✓ improved navigation when selecting sets (multi-selection is now simply possible)
- ✓ Accelerated computing time and image creation
- ✓ Improved compatibility

FKM-Modul

- ✓ A multiple copy of projects is now also possible in the FKM module. In this way, parameter studies can be performed more user-friendly.
- ✓ The calculation possibilities of the FKM module with regard to weld seams have been considerably extended and the FKM guideline has been precisely adjusted. The calculation now takes place in each coordinate direction using the stress gradient related to the coordinate direction and subsequent weighted overlay of the

load levels. The calculation now also includes the normal stress parallel to the weld seam with the possibility to enter a separate FAT class.

- ✓ In addition to the previously available hot-spot method using element stresses, the structural stress concept with linear and square interpolation is now also available.

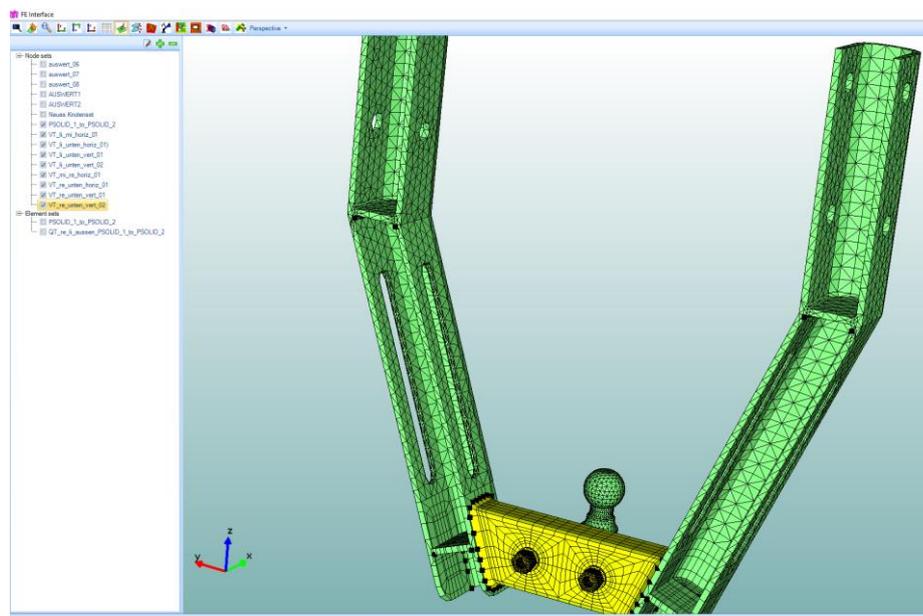


Figure 1: Selection of weld seams by definition of node and element sets also for FKM calculations

- ✓ parameter studies are possible across modules without interpretation problems, since in the FKM module the weld stresses can be calculated in the same way as in the MULTIAXIA module.
- ✓ for pressure vessel calculations, the use of stresses was implemented perpendicular to the surface. For this purpose, the three main stresses and the related stress gradients are used in the main stress directions. The stress gradient perpendicular to the surface is ignored, as provided in FKM.
- ✓ If only the strict invoice for a detection point according to FKM is to be carried out, the VIEWER4WINLIFE is not required. It appeared, however, that the user expects – as a matter of course – not only the calculation of a point, but an analysis of all the surface nodes of the entire structure.

Classification Matrix (nonlinear calculation)

- ✓ in the rough analysis with classification matrix, the intermediate maxima are taken into account.
- ✓ in the torque stress path, the comparison stress of the hysteresis is shown.
- ✓ when calculating with classification matrix, hysteresis is automatically depending on the stress mirrored.
- ✓ when calculating with classification matrix, the sign of hysteresis stress can be specified separately
- ✓ Mapping matrix via container project
- ✓ The behavior of nonlinear calculations of the drive train is now easier to check with the help of the torque stress path. The graphic shows the characteristic behaviour of the model and thus makes the assessment very much easier. The algorithm has been modified and now describes the behavior even better, which was shown by matching the invoice and the measurement. It is now possible to analyze individual areas.

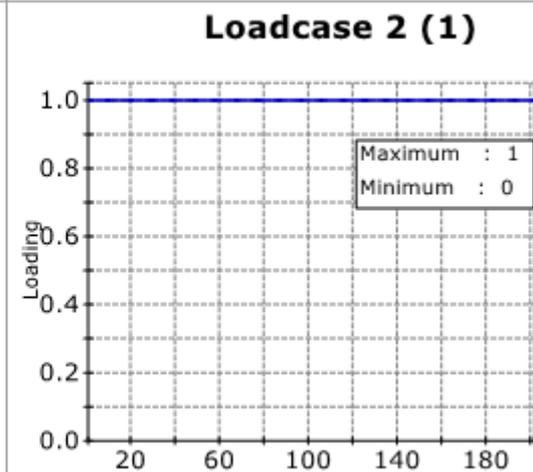
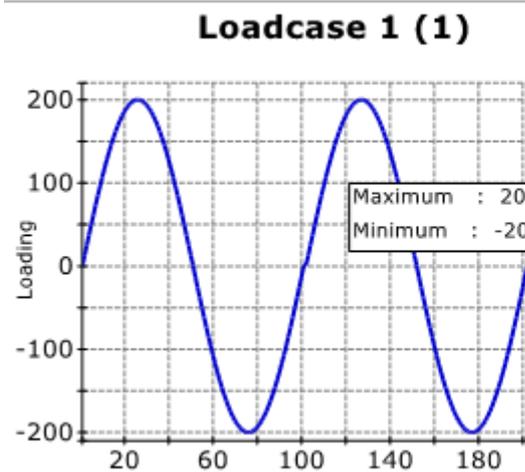
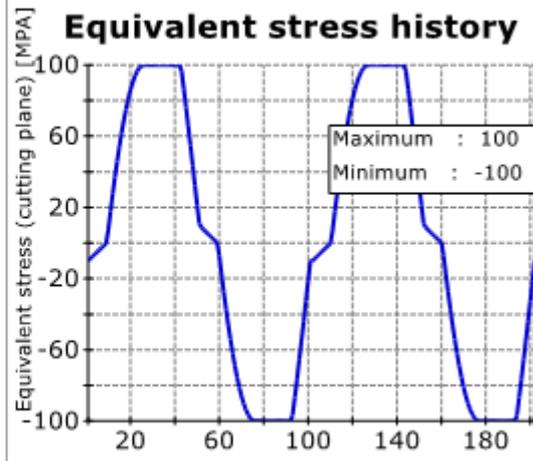
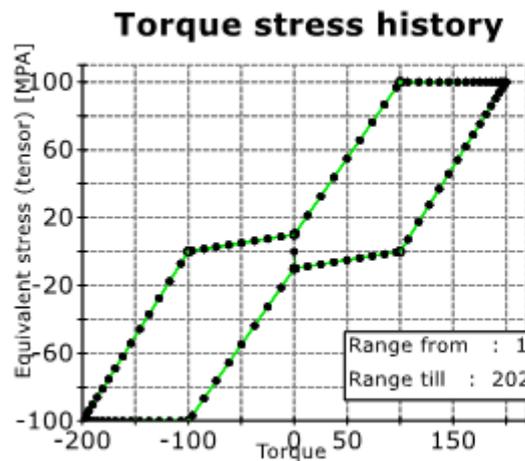


Figure 2: range of a torque stress path

Formula Editor

- ✓ Each load can now be individually processed with a formula.
- ✓ All mathematical operations are possible.
- ✓ via concatenated formulas, differences and integrals are also possible

Dynamic Modulation of ignition torque

- ✓ Dynamic modulation with container project
- ✓ additional channels can be inserted
- ✓ Status '0' now leads to no warning
- ✓ Output decimal places can be specified

Modal Super Position

- ✓ the possibility of a modal super position has been integrated. For this purpose, the modal coordinates and stresses are read from Recurdyn (Company FunctionBay ®). The modal super position allows the very efficient and fast calculation of dynamic problems. In Recurdyn, the necessary data export was integrated into the Recurdyn user interface.

✓ a very comprehensive but practical application example for the calculation of the service life a crankshaft was carried out. The following pictures show details. The theory for selecting the suitable fashions for the super position is explained in detail in our publication with No. 45.

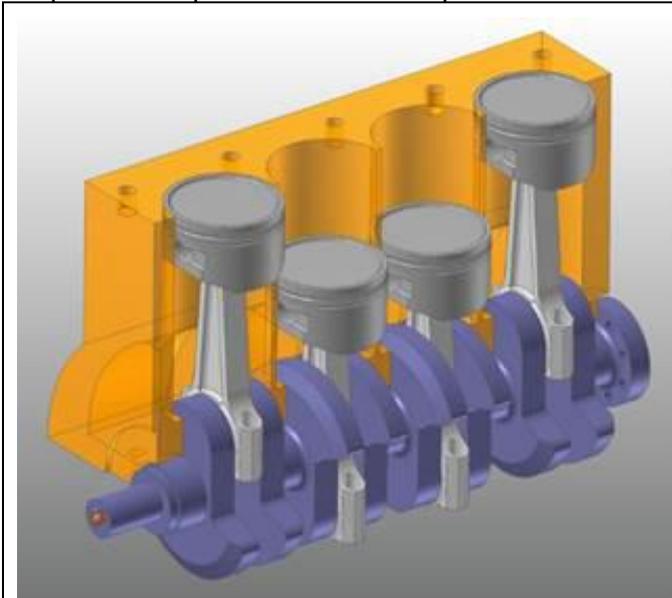


Figure 3: 4-cylinder 4-stroke engine

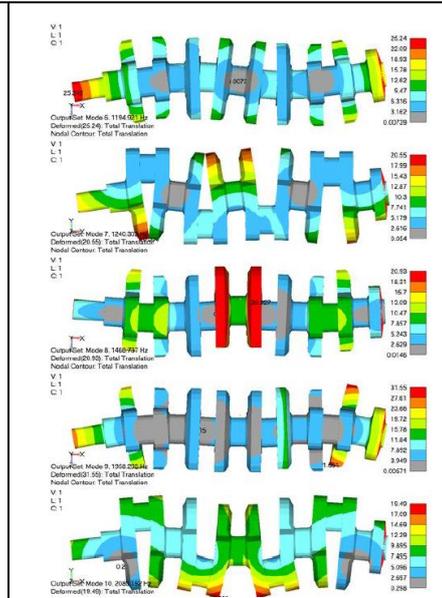


Figure 4: stress results for the individual mode shapes

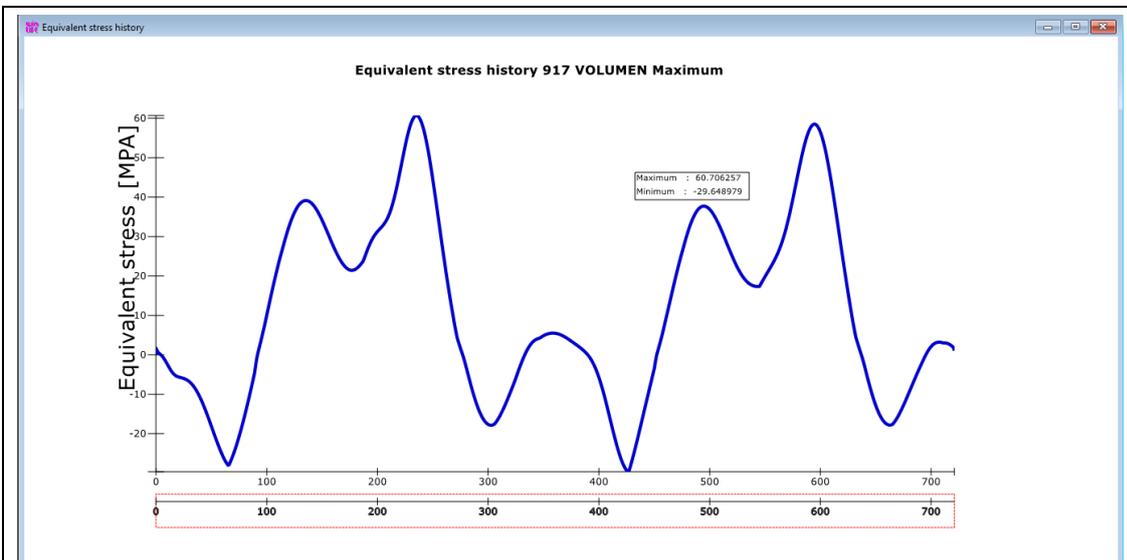
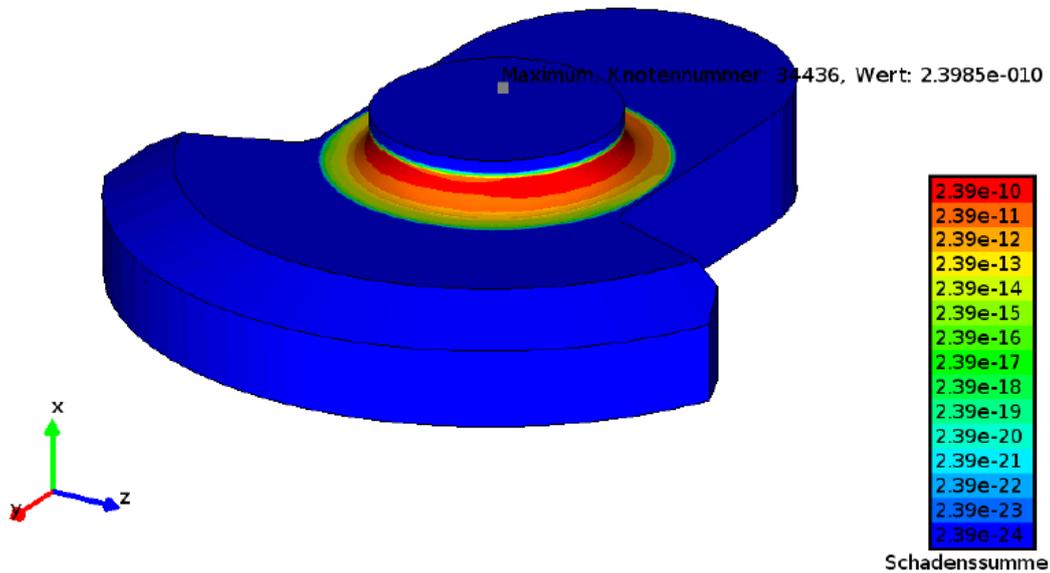
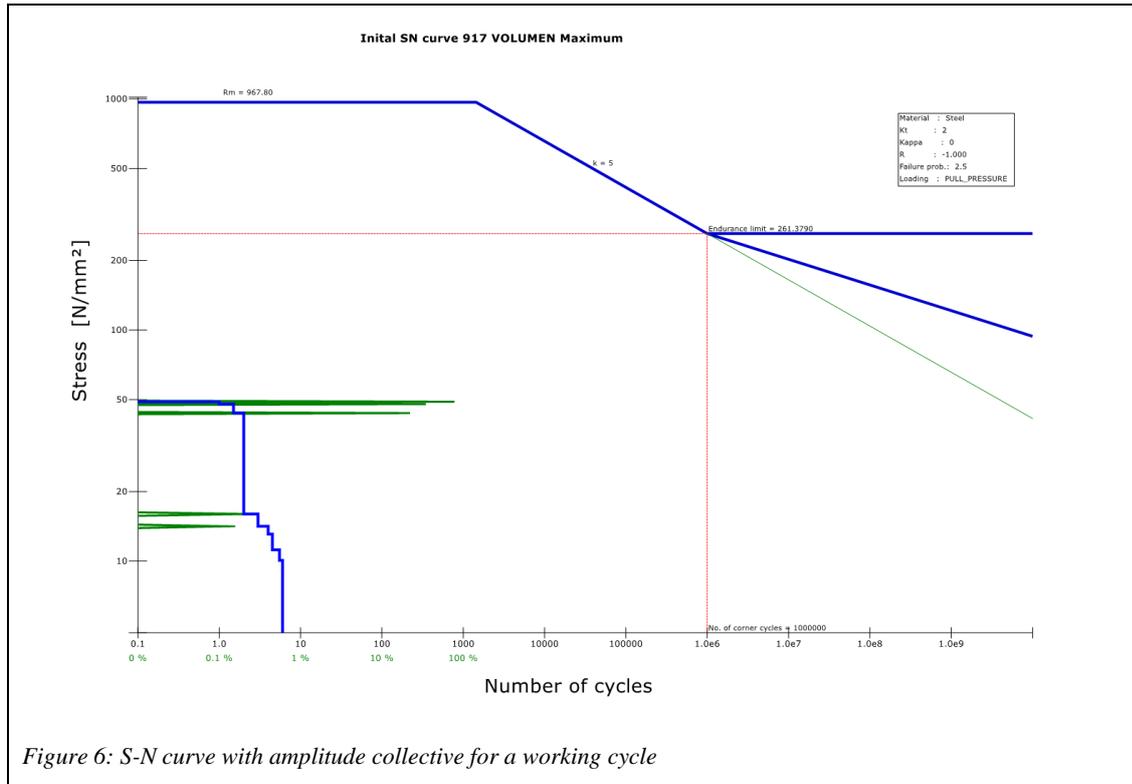


Figure 5: equivalent stress at the critical location of the crankshaft



Random Analysis by help of PSD

- ✓ the winLIFE random module has been reworked, with the graphical representation and the input mask improved. Several winLIFE customers already use this procedure to their satisfaction.



power spectral density of node: 1 (PSD_sigma_freies_example.lst)

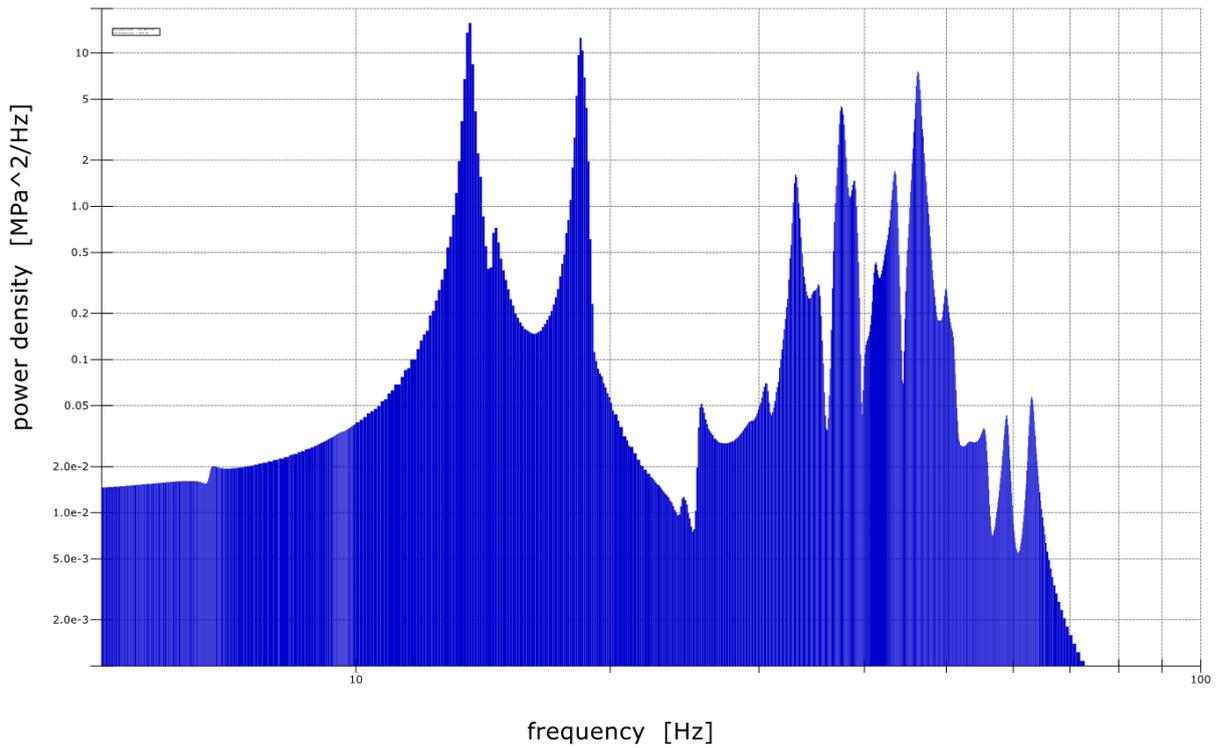


Figure 8: Power Spectral Density (PSD) of stress on a node the fatigue life was calculated.

Initial SN curve psd_F_z_pos20

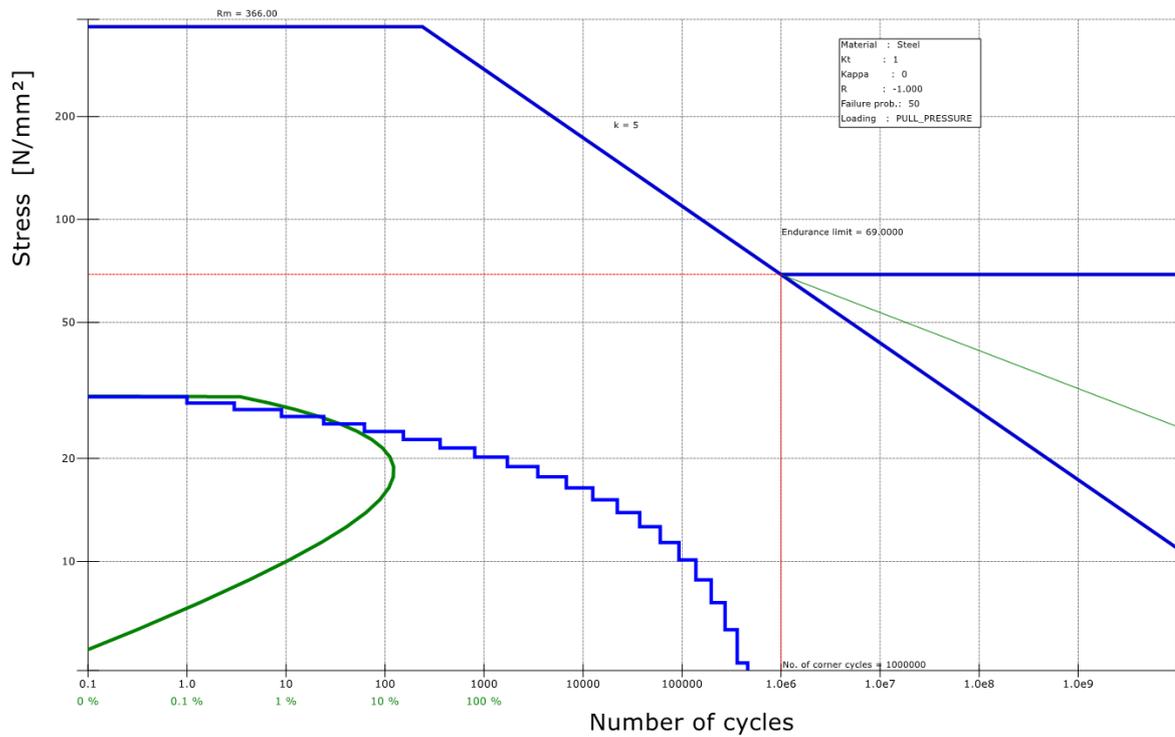


Figure 9: S-N curve and the PSD damage equivalent amplitude collective

Generation of damage-equivalent time histories from level collectives

- ✓ in the event of non-linear problems, it may be useful to generate collectives to loading histories. A corresponding option is now available in winLIFE. The pictures on the upper left show the collective and right the (almost) damage equivalent loading history. Exact damage equality cannot be achieved because a load-time history occurs during transitions between the level residues that are ignored in the collective

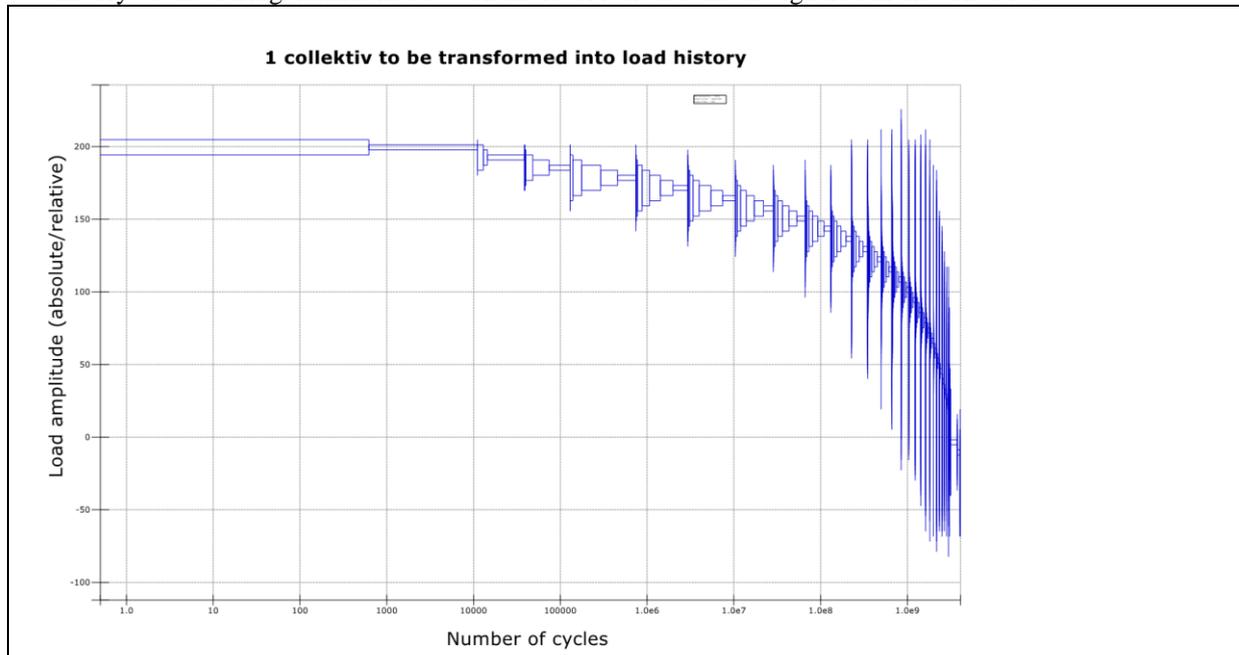


Figure 10: Amplitude collective

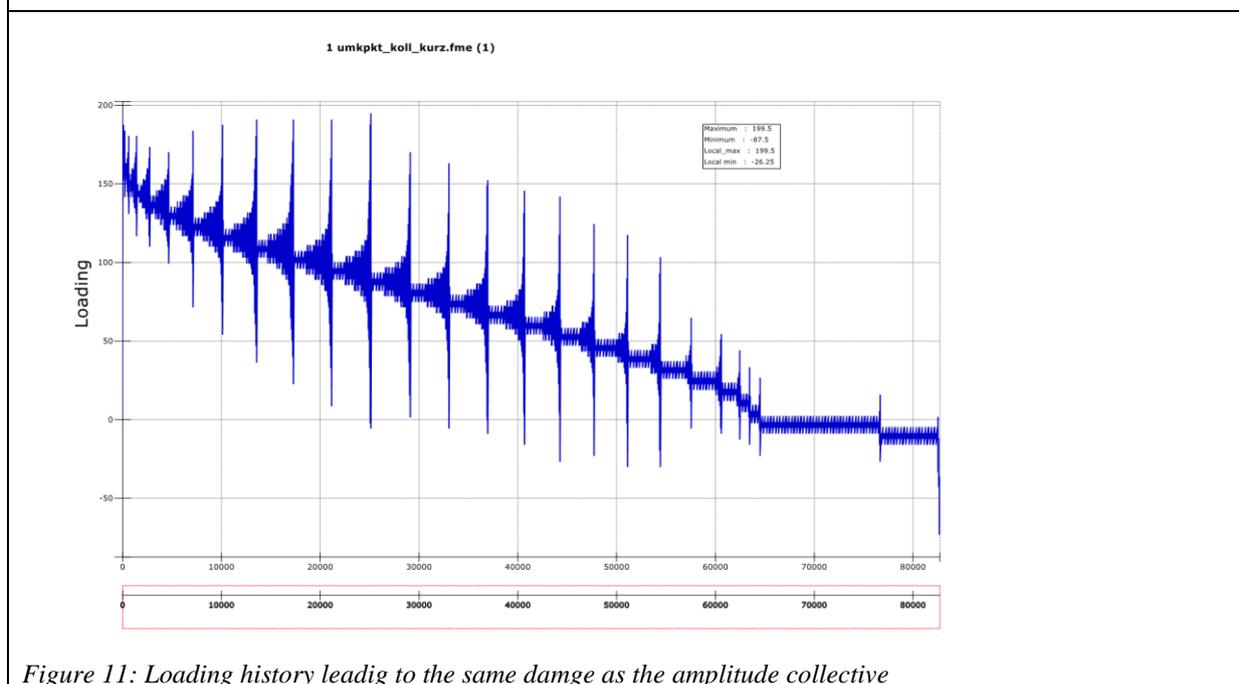


Figure 11: Loading history leading to the same damage as the amplitude collective