



Siemens PLM Software

# NX Advanced Durability

## In-depth fatigue and life analysis

### Benefits

- Improves product design robustness by determining the life of product designs
- Reduces physical testing costs by enabling you to analyze product life in a virtual environment
- Accelerates product development by enabling you to quickly perform what-if "re-analysis" of new designs to understand the impact of design changes on product durability

### Summary

NX™ Advanced Durability software helps to validate a product's structural integrity over its entire lifecycle under either simple or complex loading conditions. Expert analysts use this solution to perform in-depth fatigue analysis and life calculations to help them determine product durability based on NX Nastran®, NX Response Simulation, MSC Nastran, ANSYS and Abaqus solutions. NX Advanced Durability is provided as an add-on module to NX Advanced FEM or NX Advanced Simulation.

### An advanced toolset for determining product life and fatigue damage

NX Advanced Durability provides a set of analytical tools to predict the life of products and evaluate their fatigue resistance when they are subjected to prescribed stress and/or strain histories residing in NX structural solutions. Advanced Durability can estimate the damage incurred during single or multiple events. Damage and life results are displayed as contour plots on your model for intuitive interpretation.

The durability meta-solution process can contain multiple static and transient events. An event is comprised of:

- An NX or imported stress analysis solution
- Durability solver settings
- Element and material selection

The durability solution process can calculate the strength and fatigue results for:

- Each event separately
- All the active events in the durability meta-solution process

There are three types of events.

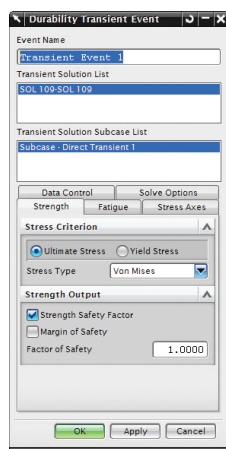
**Static events**, which determine the strength safety factors, fatigue safety factors and fatigue life of your structural model with respect to a static solution on which predetermined cyclical loading patterns are superimposed. A static event references stress and strain results from the following solutions:

- NX Nastran or MSC Nastran: SESTATIC 101 – single constraint and SESTATIC 101 – multi-constraint
- Ansys: linear statics
- Abaqus: static perturbation

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**Transient events**, which determine the strength safety factors, fatigue safety factors and fatigue life of your structural model with respect to time-domain transient loading. A transient event references results from the following solutions:

- NX Nastran: SEDTRAN 109 and SEMTRAN 112
- NX response simulation (.rs2 files that contain geometry information)
- NX Nastran SEMODES 103: flexible body solution with the flexible body recovery option defined
- NX Nastran advanced nonlinear: ADVNL 601,129 and ADVNL 701 (linear stresses and strains)
- Multibody dynamics simulation: ADAMS and Recurdyn .mdf files



**Random events**, where expected fatigue damage and life are calculated for random excitation specified through a Power Spectral Density (PSD). NX Response Simulation random events are used as input.

## Strain gage durability

Leg strain data from strain gage rosettes may be used to compute fatigue damage using the Strain Gage Rosette Analyzer and Evaluate Damage commands. The strain gage rosettes may be real strain gage rosettes generating measurement data or virtual rosettes simulated within NX Response Simulation.

Advanced Durability supports the following:

## Life criteria

- Stress life (including Dang Van multiaxial fatigue)
- Strain life
- Smith-Watson-Topper
- Weld life (BWI and TWI)
- Plate thickness correction for stress life and weld life
- User-defined stress life and strain life curves supported

## Stress direction approaches

- Principal axes
- Maximum damage
- Critical plane

## Stress/strain states

- Uni-axial
- Bi-axial

## Mean stress effects

- Goodman
- Morrow
- Soderberg
- Gerber

## Notch effects

- Neubers method
- Fuchs method

## Cyclic stress-strain relations

- Ramberg-Osgood
- Power hardening
- Linear

## Rainflow cycle counting

- Range-mean matrices written to spreadsheet

## Random fatigue methods

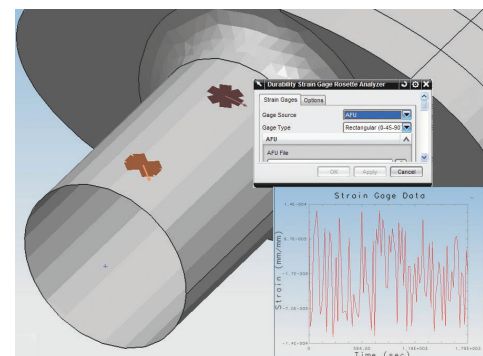
- Narrow band (Miles)
- Wide band (Dirlik)

## NX Integration

- Leverages geometry associativity to quickly evaluate the impact of changing geometrical features on fatigue resistance
- Includes NX Durability Wizard

## Postprocessing

- Contour plots for fatigue life, damage and safety factors
- Durability reports
- Crack initiation direction



## Contact

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