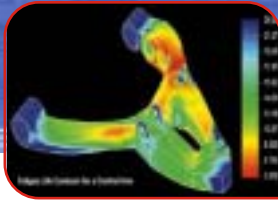


NISA - Endure



NISA-ENDURE is a general purpose software for analyzing the fatigue performance and fracture characteristics of engineering structures and components. The program is completely menu-driven and extremely user friendly. It employs the latest theories to determine crack initiation and crack propagation lives for fatigue analysis and to evaluate fracture parameters. ENDURE provides various analysis models and allows different types of load and material data descriptions such as those encountered in aerospace, offshore, and automobile structures. ENDURE is directly interfaced with NISA II and other commercially available finite element

LOADING

Deterministic Representation

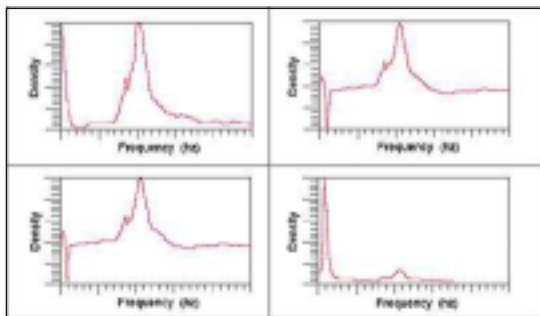
- Peak-Valley/ Range-Mean matrix type
- Cumulative exceedence curves
- Sequential variable amplitude histories/ Variable amplitude spectra

Probabilistic Representation

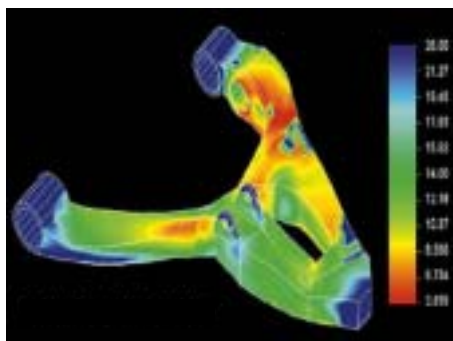
- Power Spectral Density (PSD) for random load representation

Counting Methods available;

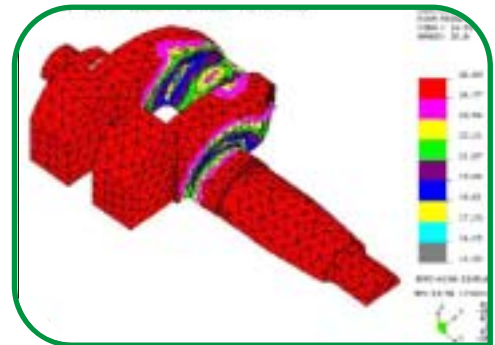
Peak, Level-Crossing, Range, Range-Mean and Rain-flow



2x2 PSD Load Matrix for a Control Arm



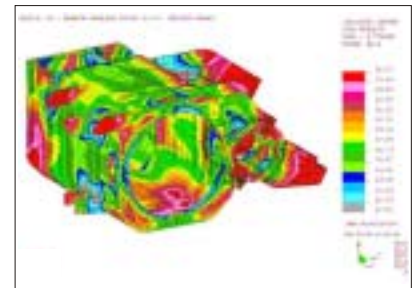
Fatigue Life Contours for a Control Arm



Log (Life) contours on crank shaft

STRESS INPUT

- Manual input during preliminary design
- Direct interface with static and dynamic analysis results of NISA II
- Input of dynamic effects including random vibration



Log (Life) contours on traction motor

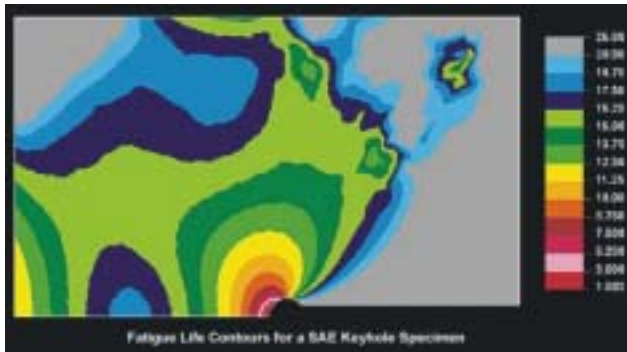
MATERIAL DATA

- Access to ready to use material data files for popular materials
- User defined material data input
- Low cycle fatigue properties
- Crack propagation properties
- Work with multi-material combinations for crack initiation problems

CRACK INITIATION

- Multi-channel and multi-loadcase capabilities
- Complex multiaxial stresses and out-of-phase fatigue simulations
- Stress-Life (S-N) or Strain-Life (e-N) correlation Memory effects & nonlinear material response

NISA - Endure



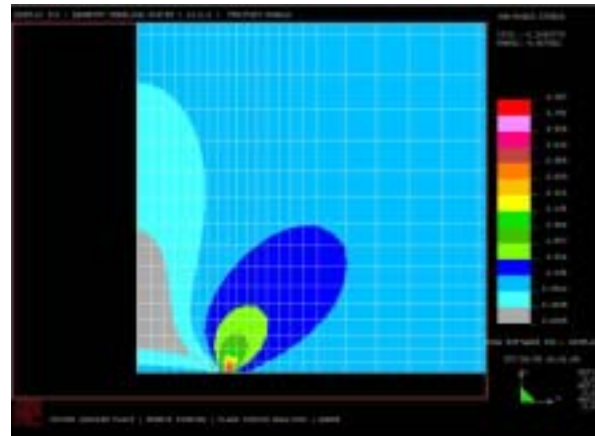
- Path independent J-Integral under elastic and elasto-plastic conditions (Delta J)
- Non-Linear elastic multi-load step analysis
- Material non-linear elastic analysis (EPFM)

CRACK PROPAGATION

- User supplied 'a' vs. 'K' correlation using fracture analysis results
- Built-in crack configurations
- Crack growth models: Paris, Forman, and Collipriest
- Crack closure models: Elber

FRACTURE

- Single and/ or mixed mode fracture analysis
- Quarter-point isoparametric elements around crack tip for accuracy
- Stress Intensity Factor (SIF) estimation
 - Crack Tip Opening Displacement (CTOD)
 - Virtual Crack Extension (VCE)
- Strain Energy Release Rate (SERR) estimation
 - J-Integral
 - Virtual Crack Closure Integral (VCCI)
 - Modified Crack Closure Integral (MCCI)
 - Equivalent Domain Integral (EDI)



Cracked Plate in Remote Tension
Plane Stress Analysis, Quarter NODE

Cranes Software International Limited is a leading provider of Computer Aided Engineering (CAE) services to the Automotive, Aerospace, Energy & Power, Civil, Electronics and Sporting Goods industries. Over 70 dedicated scientists, technology architects and software engineers providing NISA based solutions have helped major engineering companies reduce analysis turnaround time, improve user productivity, and ensure faster return on investments. The Company has its presence in 33 countries across the world and has a user base of more than 350,000.

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