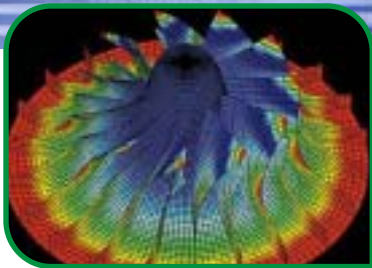
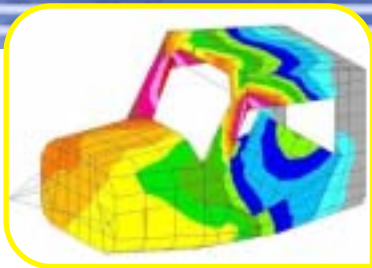
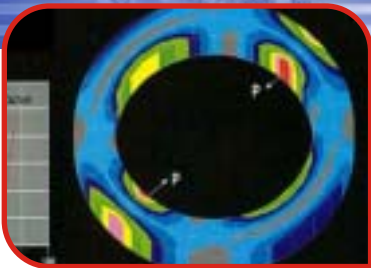


NISA II - STATIC & DYNAMIC ANALYSIS



NISA II is the parent program of the NISA family. It offers an impressive list of linear/non-linear static/dynamic analysis features complemented with an extensive finite element library. NISA II has efficient solvers like direct (frontal and sparse) and interactive solvers.

Element Type (Superscripts)	EQP	Linear	Parabolic	Cubic	Composite Elements
<ul style="list-style-type: none"> Plane Stress Plane Strain Axisymmetric Solid 	88, 89				<ul style="list-style-type: none"> Sandwich Shell Weldment/Flange Impulsive Incompressible Inelastic
<ul style="list-style-type: none"> Axisymmetric Shell 	88, 89, 90				<ul style="list-style-type: none"> Laminated Shell Elements in compression zone (Shell for elastic analysis)
<ul style="list-style-type: none"> Axisymmetric Solid with Non-Uniform Loading 	88, 89, 90				<ul style="list-style-type: none"> Stressy Solid
<ul style="list-style-type: none"> Axisymmetric Shell with Non-Uniform Loading 	88, 89, 90, 91, 92				<ul style="list-style-type: none"> Weldment & Flange Impulsive Inelastic zone Weldment
<ul style="list-style-type: none"> General and Thin Shell Laminated Composite Shell Sandwich Composite Shell 	88, 89, 90, 91, 92				<ul style="list-style-type: none"> Weldment Weldment Weldment Weldment
2D Thin Shell					
	88, 89, 90			Other Elements <ul style="list-style-type: none"> 1D, 2D, 3D Beams (with and without inelasticity) Spring, Axial Spring, Torsional Spring Beam Elements 2D and 3D with Friction Beam Elements with tension only or 2D/3D inelasticity Cable Elements 	
3D Solid Elements					
	88, 89, 90, 91			<ul style="list-style-type: none"> 2D and 3D Surface Contact Element with Friction 	
3D Beam Elements					

NISA II FINITE ELEMENT LIBRARY

Linear Static Analysis

STATIC ANALYSIS FEATURES

- Multiple load cases
- Linear buckling analysis
- Automatic wavefront optimization
- Interlaminar shear and edge effects for composite elements
- Restarts
- Automatic submodeling in user-defined regions for more accurate stress calculations

MATERIAL PROPERTIES

- Isotropic or orthotropic, temperature dependent
- Directional tensile, compressive, and shear failure stresses for composite elements
- Tsai-Wu coupling coefficients for composite structures

LOADING

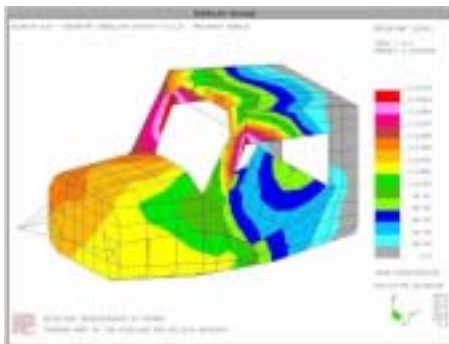
- Point force, moment on nodes or range of nodes in local or global coordinate system
- Distributed force, pressure load
- Linear, angular acceleration
- Thermal loading
- Temperature distribution may be obtained from NISA II/HEAT TRANSFER analysis
- Specified displacement

BOUNDARY CONDITIONS

- Specified nodal displacement (zero/ non-zero; translation or rotation)
- Coupled displacement; multipoint constraints

PRINTED AND GRAPHICAL OUTPUT

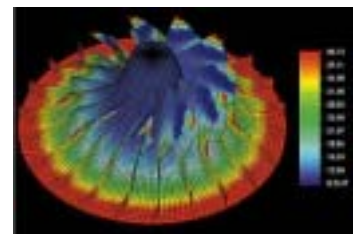
- Displacements, stresses, and strains at elements and nodes
- Principle stresses and their directions
- von Mises, maximum shear, and octahedral shear stresses
- Averaged and unaveraged nodal stresses, element stresses at Gauss points and centroid
- Buckling load forms and mode shapes



Linear Dynamic Analysis

EIGENVALUE ANALYSIS

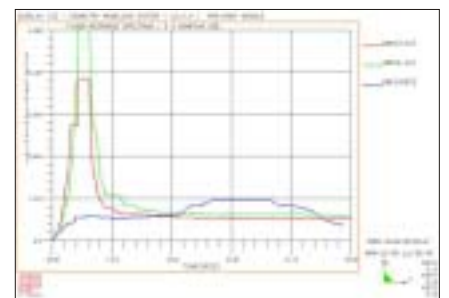
- Natural frequencies and mode shapes
- Modal stresses and strain energy computation
- Eigenvalue extraction algorithms
 - Conventional subspace iteration
 - Accelerated subspace iteration
 - Lanczos Method
 - Inverse iteration
 - Guyan reduction
- Extraction of zero frequencies (rigid body modes) and coincident frequencies
- Component mode synthesis to evaluate natural frequencies and mode shapes for:
 - Normal structures, given the mode shapes of the substructures or components
 - Cyclic symmetric structures, given the mode shapes of one sector

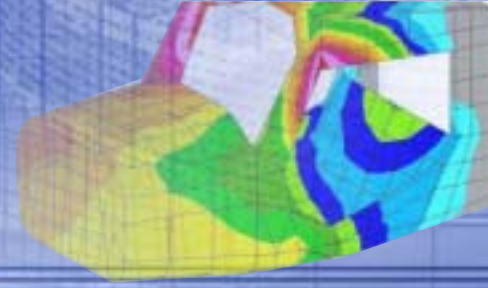


Bending Mode of an Impeller

MODAL DYNAMIC ANALYSIS

- Viscous, structural, proportional and material damping
- Capabilities to handle rigid body modes
- Transient Dynamic Analysis
 - Time dependent ground excitations, nodal forces, and pressure loading
 - Nonzero initial displacements
 - Time dependent loads using time functions and arrival times
 - Time history and snapshot output for displacements, velocities, accelerations, stresses, reactions, and beam end forces
 - Generation of floor response spectra
- Frequency response analysis
 - Frequency dependent harmonic ground excitations, nodal force, and pressure loading
 - Amplitude and phase spectrum input
 - Point-to-point transfer function calculation





- Amplitude and phase spectra output for displacements, velocities, accelerations, reactions, and beam end forces
- Random Vibration Analysis
 - Stationary nodal forces, ground excitations, and pressure loading
 - Non-Stationary inputs
 - Auto PSD and complex cross PSD input
 - Numerical or exact integration of the PSDs to compute the covariance matrices
 - Auto PSD output for displacements, velocities, accelerations, stresses, reactions, and beam end forces
 - RMS responses for displacements, velocities, accelerations, stresses, reactions, and beam end forces
- Shock (response) spectrum analysis
 - Multi directional displacement, velocity or acceleration spectra input
 - Modal combination rules
 - Absolute sum
 - Square root of sum of squares or RMS sum
 - Peak RMS or NRL sum
 - Complete quadratic combination (CQC) sum
 - Direction combination by RMS or absolute sum
 - Automated mode selection and spectra computation by U.S. Navy DDAM method
 - Missing mass correction

NISA DYSPAN (Dynamic Spectrum Analyzer)

- Response spectrum generation
- PSD generation
- Spectrum compatible time history generation
- FFT generation

DIRECT TRANSIENT DYNAMIC ANALYSIS

- Newmark-Beta method for implicit time integration
- Lumped and consistent mass formulation
- Discrete damper elements and proportional (Raleigh) damping
- Nonzero initial conditions
- Time dependent boundary conditions
- Forces due to moving frames of references
 - Centrifugal forces
 - Coriolis forces
 - Linear and angular forces
- Time dependent concentrated and distributed loading Absolute motion of unconstrained structures

Non-linear Static & Dynamic Analysis

MATERIAL NONLINEARITY

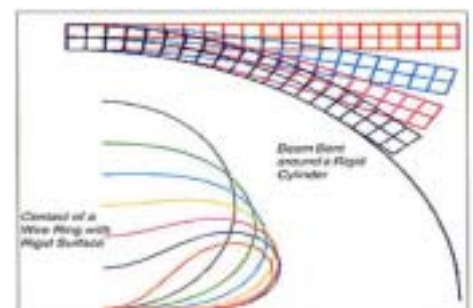
- Material models include von Mises, Tresca, Mohr-Coulomb, and Drucker-Prager yield criterion
- Elastic perfectly plastic, elastoplastic with isotropic, kinematic or mixed work hardening
- Uniaxial stress-strain curve description includes elastic perfectly plastic, elastic linear hardening, elastic piece-wise linear hardening, and Ramberg-Osgood curve
- Hyperelasticity and rubber-like material behavior, material models include generalized Mooney-Rivlin, Blatz-Ko, Alexander, etc.
- Creep laws such as Norton, McVetty, Soderberg, Dorn, ORNL, etc. are supported. These laws can be expressed as general functions of time, stress, and temperature
- Anisotropic elastoplastic material model with linear or piece-wise linear hardening for composite shell elements
- Temperature dependent inelastic properties
- User-defined material model

GEOMETRIC NONLINEARITY

- Large displacements, large rotations, finite strains
- Total and updated Lagrangian formulation
- Large strain deformation
- Stress stiffening
- Post buckling analysis

CONTACT CAPABILITIES

- Simple 2D and 3D node-to-node contact elements with friction
- General surface-to-surface frictional contact between flexible-flexible and flexible-rigid bodies
- A priori knowledge of contact region not required
- Contact surfaces may be of arbitrary curved geometry
- Formulation accounts for nonlinear kinematics of large deformation analysis and employs consistent tangent stiffness for contact
- Master-slave implementation with single-pass or symmetric-pass treatment



NISA II - STATIC & DYNAMIC ANALYSIS

Non-Linear Static & Dynamic Analysis

- Automatic substructuring analysis, within a wavefront environment, when the nonlinearity is due to contact conditions only
- General wavefront solution scheme, with dynamic update of wavefront parameters, for general contact problems involving geometric and/or material nonlinearity

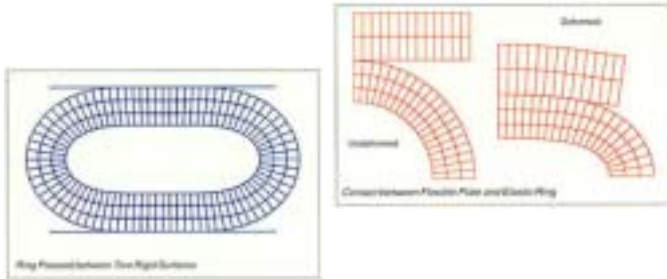
- Time integration schemes for dynamics, creep and viscous effects including Newmark, Wilson-Theta Central difference, and Houbolt methods
- Restarts from the last converged load step

NONLINEAR DYNAMICS

- Direct integration method
- Various implicit/explicit time schemes
- Consistent or lumped mass matrix
- Geometric and material nonlinear effects
- Stress stiffening
- Discrete damper elements and proportional (Rayleigh) damping
- Non-zero initial displacements and velocities, and moving boundary conditions
- Self adaptive time steps

OUTPUT

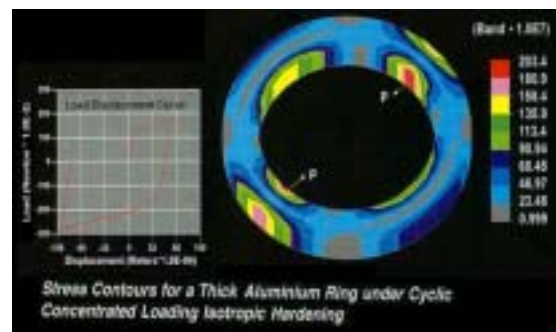
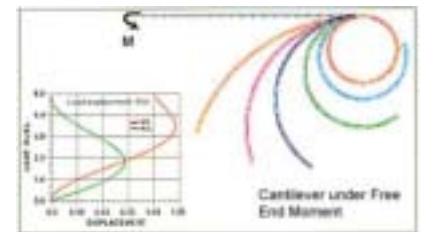
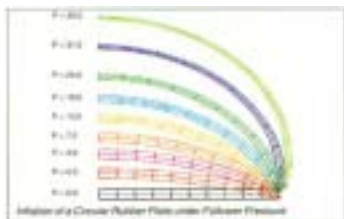
- Output at each load step or at every 'N' load step
- Stress output in second Picola-Kirchoff or Cauchy stress for geometry nonlinearity
- Nodal, Gauss point, and centroidal stresses and strains
- Multiple displacement history and stress contours



- Conservative loading (fixed direction force, moment, and pressure)
- Non-conservative loading (deformation dependent follower concentrated force and follower pressure)
- Body forces (weight and inertia)
- Thermal loading (specified temperature vs. time curve)

SOLUTION PROCEDURE

- Incremental-iterative solution procedure
- Full or modified Newton-Raphson techniques
- Special formulation for pure incremental analysis with no iterations
- Equal, user-defined or automatic load steps
- Line search for faster convergence
- Convergence checks with displacements, rotation, force, moment, and energy criterion
- ARC-length method to improve convergence characteristics specially for post-buckling and snap through problems



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.

With a mission statement to provide its customers the best in scientific technology and to enable its customers to define new limits, Cranes is setting new standards in the scientific and engineering field. For more information, please visit www.nisasoftware.com Email: nisa@cranesoftware.com

Cranes Software International Limited

Corporate office
4th Floor, Block 1,
Shankar Narayana Bldg
#25, MG Road,
Bangalore - 560 001
Ph: +91 80 51231275 /6 /7
Fax: +91 80 51231274

Bangalore
29,7th cross,14th Main,
Vasanth Nagar,
Bangalore - 560 052
India
Ph: +91 80 22381740 /41
Fax: +91 80 22268410

Delhi
C -100, Shivalik,
New Delhi 110 017
India
Telefax: +91 11 6674891 /92

Hyderabad
3rd floor, 6-3-346/1, Road.no.1
Banjara Hills
Hyderabad 500 034
Ph: +91 040 55840024 /25 /26
Telefax: +91 040 5584 0028

Pune
Bldg. B-5, Flat 23, Sr.No.11
Krishnakeval Township
Main Kondhwa Road,
Kondhwa,
Pune 411 048
Tel: +91 020 26837074,
Fax: +91020 26832793

Trivandrum
Megabyte Royal Business Centre,
Cabin 508, 5th Floor
Karimpanal Statue Avenue
GH Road, Statue
Trivandrum 695 001
Tel: +91 0471 3094541,
Fax: +910471 2467855

