ALGOR

NASTRAN

ALGOR's NASTRAN products provide full compatibility with existing NASTRAN input and output files so that NASTRAN users can benefit from our value-added capabilities. Companies using NASTRAN can benefit from the easy-to-use FEMPRO® interface, full CAD/CAE associativity with most CAD solid modelers, automatic brick and tetrahedral solid meshing and complementary analysis tools such as Mechanical Event Simulation (MES) for combined motion and stress analysis and fluid flow analysis.

NASTRAN Product Line

ALG/NASTRAN - a complete NASTRAN solution for static stress with linear material models, natural frequency (modal), critical buckling load and steady-state heat transfer analyses including the ability to import FEA models that are stored in a NASTRAN (.bdf, .dat, .nas) file and complete data exchange with third-party software, such as acoustics and fatigue applications, through industry-standard NASTRAN files (.bdf, .dat, .nas, .op2) by writing input deck data and binary output files that are NASTRAN compatible.

NASTRAN Support Extender - complete support for NASTRAN linear static stress, natural frequency (modal), critical buckling load and steady-state heat transfer FEA models including the ability to import/export NASTRAN input decks; import/export NASTRAN result output files (.op2); and directly run a NASTRAN solver within FEMPRO, a complete finite element modeling, results evaluation and presentation interface.

➤ Customer Application

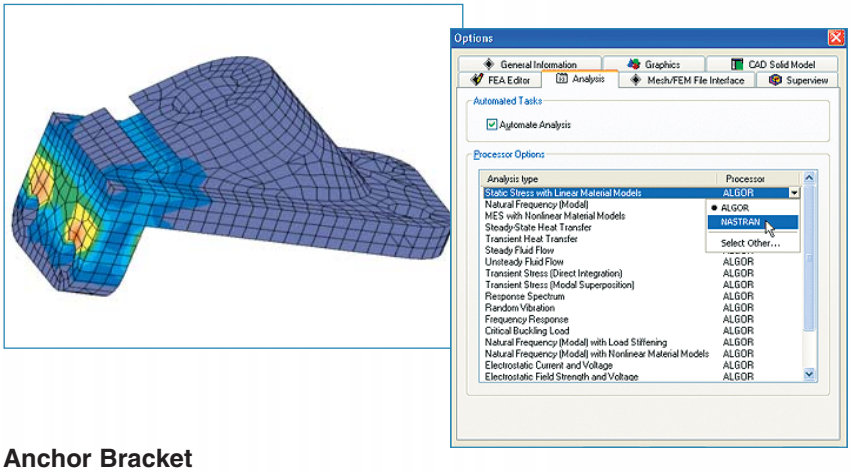
"ALGOR's NASTRAN products have improved our existing product development process because they enable us to work with existing NASTRAN files within an easy-to-use FEA environment with extensive results evaluation and presentation capabilities."

Dominic Lorino
Huber, Inc.

Sterngate for Vessel

Huber, Inc. uses ALGOR's NASTRAN products to work with existing NASTRAN models within FEMPRO. Shown here (bottom) is a model of the lower sterngate for the LPD-17 USS San Antonio Class warship. The location of the sterngate is indicated in the cut-away artist rendition.

➤ Typical Application



Anchor Bracket

In addition to using ALGOR's default analysis solvers, you can alternatively run a NASTRAN or other commercial solver or a custom-written application within FEMPRO. The capability to choose the solver provides additional flexibility for your analysis needs by enabling you to "plug and play" solvers as needed.

For the complete customer application story and more, visit:
http://www.algor.com/news_pub/default.asp

NASTRAN Features

Analysis Capabilities
- Static stress with linear material models (SOL 101)
- Natural frequency (modal) (SOL 103)
- Critical buckling load (SOL 105)
- Steady-state heat transfer (SOL 101 with APP HEAT)

Modeling
- Capability to import FEA models that are stored in a NASTRAN (.bdf, .dat, .nas) file
- Capability to export ALGOR FEA models to a NASTRAN (.bdf, .dat, .nas) file
- Beam modeling including direct access to AISC section property data
- See the FEMPRO (Part No. 3201.326) and CAD Support (Part No. 3201.331) product data sheets for additional modeling features

Element Library
- Spring element (PELAS/CELAS1)
- 3-D truss element (PROD/CONROD/CROD)
- 3-D beam element (PBAR/CBAR)
- 3-D membrane plane stress element (PSHELL/CQUAD4/CTRIA3)
- 3-D plate element (PSHELL/CQUAD4/CTRIA3)
- Thin composite element (PCOMP/CQUAD4/CTRIA3)
- 3-D brick element (PSOLID/CHEXA/CPENTA/CTETRA)
- 3-D tetrahedral element (PSOLID/CTETRA)
- Gap element (PGAP/CGAP)
- Rigid element (RBE2)
- Thermal rod element (PROD/CONROD/CROD)
- Thermal plate element (PSHELL/CQUAD4/CTRIA3)
- Thermal brick element (PSOLID/CHEXA/CPENTA/CTETRA)
- Thermal tetrahedral element (PSOLID/CTETRA)

Material Models
- Linear elastic isotropic (MAT1)
- Linear elastic orthotropic (MAT2/MAT8/MAT9)
- Linear temperature-dependent isotropic (MATT1)
- Linear temperature-dependent orthotropic (MATT2/MATT9)
- Thermal isotropic (MAT4)
- Thermal orthotropic (MAT5)
- Temperature-dependent thermal isotropic (MATT4)
- Temperature-dependent thermal orthotropic (MATT5)

Loading and Constraints
- Forces (FORCE)
- Surface forces (PLOAD4)
- Edge forces (FORCE)
- Moments (MOMENT)
- Temperatures (TEMP/TEMPD)
- Surface temperatures (TEMP/TEMPD)
- Prescribed displacements (SPCD)
- Surface prescribed displacements (SPCD)
- Edge prescribed displacements (SPCD)
- Prescribed rotations (SPCD)
- Surface prescribed rotations (SPCD)
- Edge prescribed rotations (SPCD)
- Pressures and tractions (PLOAD4)
- Variable surface loads (PLOAD4)
- Hydrostatic pressures (PLOAD4)
- Distributed loads (PLOAD1)
- Gravitational and centrifugal forces (GRAV/RFORCE)
- Global and off-axis constraints (SPC/SPC1)
- Global and off-axis surface constraints (SPC/SPC1)
- Global and off-axis edge constraints (SPC/SPC1)
- Variable-stiffness off-axis constraints (CELAS2)
- Variable-stiffness off-axis surface constraints (CELAS2)
- Variable-stiffness off-axis edge constraints (CELAS2)
- End releases (CBAR)
- Twisting plate elements (PSHELL/CQUAD4/CTRIA3)
- Lumped masses (CONM1/CONM2)
- Mass moments of inertia (CONM1/CONM2)
- Initial temperatures (TEMPD)
- Applied temperatures (SPOINT)
- Surface temperatures (TEMPD/SPOINT)
- Convection (PCONV/CONV)
- Radiation (RADBC/RADM)
- Heat flux (QBDY1)
- Internal heat generation (QVOL)

Solver Options
- Ability to specify choice of ALGOR or NASTRAN solver
- Sparse Lanczos eigensolver
- Symmetric sparse
- Unsymmetric sparse
- Skyline
- Algebraic multigrid (AMG) iterative
- Banded
- Parallel processing for multiple processors
- Distributed memory processing (32- and 64-bit Linux [Red Hat])

Results Evaluation
- Capability to import results data from NASTRAN output files (.op2)
- Integrated environment for model visualization and results evaluation
- 3-D dynamic viewing options and rich colors provided by OpenGL-based displays
- Result displays of:
  - Displacement, stress and strain
  - Strain energy density
  - Factor of safety
  - Vector plots of principal stress directions
  - Plate/shell thickness
  - Isosurfaces
  - Static temperature distribution, heat flow and heat flux
- AISC (ASD 1989) code checking
- Shear and bending moment diagrams
- Stress linearization utility for use with a linear static stress analysis on 2- or 3-D thin-walled structures
- Automated tools for multiphysics simulation to:
  - Transfer temperature results to a static stress analysis, MES or electrostatic analysis
  - Couple heat transfer and fluid flow analysis to accurately simulate natural, forced or mixed convection
- See the FEMPRO product sheet (Part No. 3201.326) for additional results evaluation features

Results Presentation
- Capability to export results data from ALGOR analyses to NASTRAN output files (.op2) for use in other NASTRAN or NASTRAN-compatible applications such as acoustics and fatigue
- See the FEMPRO product data sheet (Part No. 3201.326) for additional results presentation features

User Interface
- Automatic view factor calculator for determining the amount of radiation to be passed between bodies in a steady-state heat transfer analysis based on user-specified input
- Film/Convection Coefficient Calculator for open (external), closed (internal) and buoyant flows uses classical correlations to estimate the heat transfer coefficient between a solid and adjoining fluid
- See the FEMPRO product data sheet (Part No. 3201.326) for additional user interface features

Note: For complete details on our NASTRAN features, see the "Products" section of www.ALGOR.com. ALGOR's web site contains additional information about our wide range of simulation capabilities including static stress and Mechanical Event Simulation (MES) with linear and nonlinear material models, linear dynamics, fatigue, steady-state and transient heat transfer, steady and unsteady fluid flow, electrostatics, full multiphysics and piping.

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