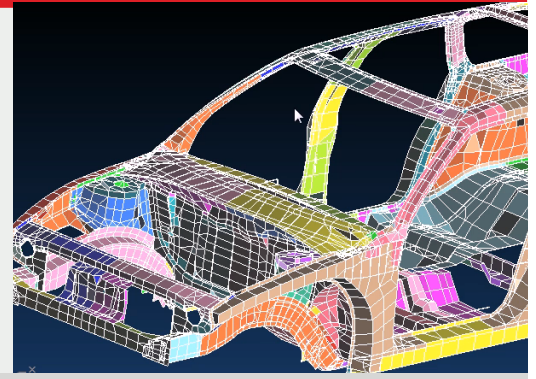# MSC Nastran™ Dynamics
Quickly Assess the Dynamic Behavior of Components and Assemblies

Overview

Understanding dynamic behavior of structures is critical for product safety in many industry applications. Automotive engineers work to ensure ride comfort and cabin noise control in automobiles. Aerospace engineers strive to control the vibration and noise from aircraft engines and provide superior cabin comfort. Understanding of dynamic response of buildings and bridges subjected to earthquakes and winds is important for civil engineers. Numerous other examples can be found in machinery, electronics, energy and other industries, where dynamic behavior plays a crucial role in their performance, customer satisfaction, safety, and longevity of the product.

MSC Nastran, industry leading multidisciplinary FEA solver, provides a complete solution to virtually test products, big or small, for their dynamic behavior subjected to a variety of loads, reducing product development costs, while improving safety and performance of the designs. With highly scalable, computationally efficient algorithms for modal response and frequency response analysis, MSC Nastran is well suited to solve very large models. It is also possible to conduct a random analysis to analyze structural response to earthquake and wind loads. Response and shock spectra generation and analysis provide the capability to combine the modal responses to determine peak physical responses. Additionally, transient response analysis, which is the most general method for computing forced dynamic response, enables users to compute the behavior of a structure subjected to time varying excitations.

Business Value

- **Lower warranty costs:** Ensure performance of the products subjected to realistic loads through comprehensive testing.

- **Higher engineering productivity:** Take advantage of the fast, efficient computational algorithms to analyze models of any size, from a single component to entire vehicle.

- **Accelerated time-to-market:** Perform extensive virtual testing prior to creating physical prototypes to gain insights into new designs and reduce uncertainties.

- **Achieve Lower Warranty Costs:** With precise representation of complex interactions between disciplines, make better design decisions and avoid unexpected operational failures during use.

Capabilities

- Multiple dynamic related analysis types
  - Eigenvalue analysis (real and complex)
  - Frequency response
  - Transient response
  - Random analysis with coupled excitations
  - Shock and Response spectrum analysis
- Represent complex damping
- Use one of many available eigenvalue extractors
- Define numerous and diverse load cases
- Perform analysis quickly with: Parallelization, GPUGPU, ACMS, and more
- Utilize glued contact technology
- Integrate dynamic analysis and Adams, the multibody dynamics simulation solution
- Access multiple analysis types outside of dynamic analysis

Benefits

- Determine the dynamic behavior of large, intricately loaded and detailed components and assemblies
- Make critical design changes based on accurate dynamic simulations
- Bring simplicity, speed, and flexibility to dynamic simulation

MSC✗Software®
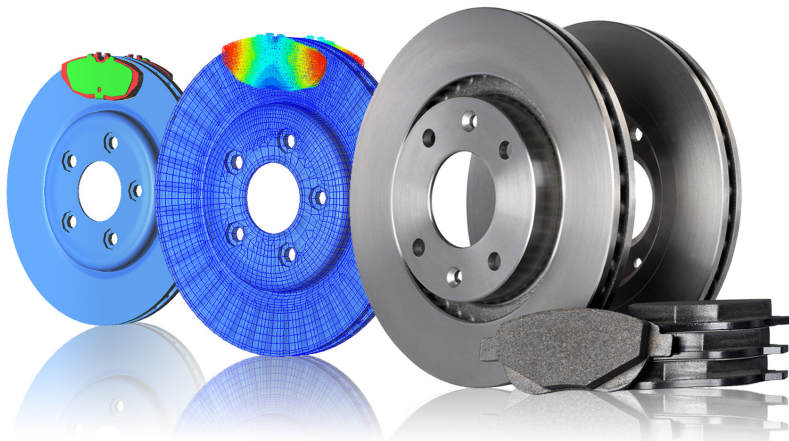
Complete Dynamic Analysis Solutions

- Normal modes (Real Eigenvalue) analysis
- Complex eigenvalue analysis
- Frequency response analysis
- Transient response analysis
- Random analysis with coupled excitations
- Shock and Response spectrum analysis
- Nonlinear transient analysis

Assembly and Mulitidisciplinary Analysis

- Superelements
- Design optimization and sensitivity
- Acoustic (Coupled Fluid-structure) analysis
- Glued Contact
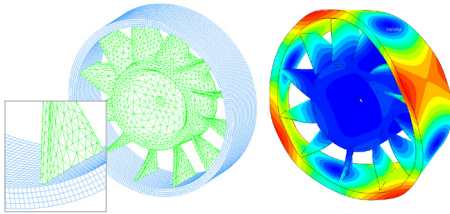
High Performance for Dynamic Analysis

- Automated component mode synthesis (ACMS)
- Parallelization across multi core systems and computer clusters
- Accelerate CPU computation with GPGPU hardware
- Highly tuned math kernels for multi-threaded matrix algebra operation
- Fast frequency response solvers
- Enhanced nonsymmetric solvers
- Efficient memory use for reduced disk I/O and improved CPU utilization

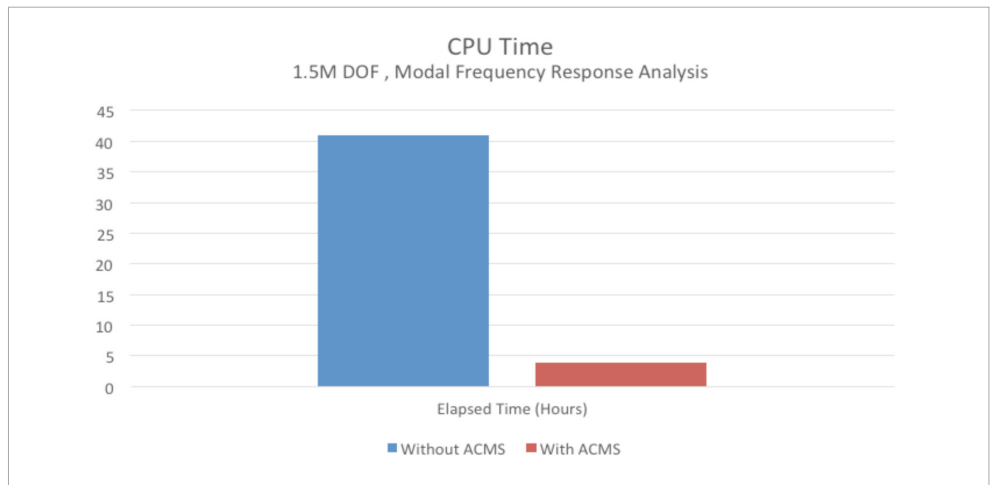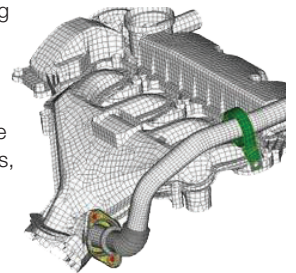## Damping to Fit Your Modeling Scenarios

- Viscous, with direct matrix input option
- Structural/Hysteretic , with direct matrix input option
- Modal
- Rayleigh
- Hybrid
- Nonlinear

Choice of Eigenvalue Extractors

- Lanczos
- Givens
- Householder
- Modified Givens
- Modified Householder
- Automatic Givens
- Automatic Householder
- Inverse Power
- Strum modified inverse power

Diverse Dynamic Loading Options

- Repurpose static loads from previous analyses for dynamic scenarios
- Enforced motion: displacement, velocity, and acceleration
- Enforced motion with loads: Large mass/spring approach, inertial loads method, Lagrange multiplier method
- Initial conditions: displacements and velocity
- Initial conditions from a static analysis
- Define frequency dependent excitations with available time delay and phase lead options
- Multiple Subcases option available for solving multiple loading conditions more efficiently
- Time delays, phase lead, time windows, and analytic and explicit function options

CPU Time
1.5M DOF , Modal Frequency Response Analysis

Elapsed Time (Hours)

■ Without ACMS ■ With ACMS