SimOffice™ is a stand-alone environment in which engineers can build, test, review, and improve their designs. SimOffice gives product development engineers the shared technologies they need to assess product performance and accelerate innovation.

The MSC.Nastran™ product family is modular, enabling you to analyze products ranging from simple components to complex structures and systems. This also enables you to start simply and to grow your analysis capabilities as your Virtual Product Development (VPD) needs expand. As part of your VPD process, you can use MSC.Nastran to assess many functional aspects of your products, such as the structural response (displacement, strain, stress, vibration, and temperature) due to its material properties and the loads and boundary conditions that are applied to it during operation.

MSC.Nastran™ Acoustics

The MSC.Nastran™ Acoustics product module performs a coupled fluid-structure analysis for acoustic and noise control analysis, for example, in the passenger compartments of automobiles and aircraft. The approach used in this analysis is called the Pressure Method, which is analogous to the Displacement Method in structural analysis except that pressures, instead of displacements, are computed at the fluid points. The velocities and accelerations of the fluid points are analogous to forces in structural analysis.

Fluid volumes are modeled with existing MSC.Nastran three-dimensional elements: CHEXA, CPENTA, and CTETRA. In addition, MSC.Nastran Acoustics provides additional acoustic elements to model acoustic barriers and absorbers.

The interface between the fluid and the structure may be modeled with matching or non matching meshes. In either case, the coupling matrices are automatically generated for stiffness and mass.

The acoustics capability is applicable to the following MSC.Nastran analyses types:
- Direct Frequency and Direct Transient Analysis:
  - SOLs 107 through 109.
- Modal Frequency and Modal Transient Analysis:
  - SOLs 110 through 112.
- Design Optimization
  - Sol 200 with ANALYSIS = DFFREQ, MFREQ, or MTRAN for Direct Frequency Response, Modal Frequency Response, and Modal Transient Response.

BENEFITS

- Improve Acoustic Performance of Product Designs through Participation Identification and More Design Iteration.
- Increase Product User Comfort and Value.
- Eliminate Noise and Vibration that Affect Product Performance, Reliability and Durability.
- Design Patentable Noise Characteristics for Product Brands to Increase Product Image or Perceived Value.
- Fluid-Structure Coupling Matrix Guarantees Grid Point Force Equilibrium.
- Fast and Highly Accurate Coupling Matrix Generation to Reduce Time and Increase Product Quality.
- New and Improved, Easy-To-Use, Flexible Input and User Interface which Reduces Model Creation Time.
MSC.Nastran modal frequency analyses, modal transient analyses, and design optimization, compute normal modes separately for the fluid and structural parts of the model. Design sensitivities may be computed with MSC.Nastran Design Optimization. For normal modes analysis (SOL 103) and pre-stressed normal modes analysis from nonlinear statics (SOL 106), the normal modes are computed separately for the fluid and structure portions of the model.

MSC.Nastran Acoustics also works in combination of MSC.Nastran ACMS (Automatic Component Mode Synthesis), a fast eigenvalue solver for large systems, to allow the calculation of more modes or model variations in shorter time.

MSC.Nastran DMP (Distributed Memory Parallel) can also be combined with MSC.Nastran ACMS to perform acoustic analysis using computers with multiple processors or multiple computers connected to a network to be able to calculate more modes (higher frequency range or smaller frequency steps), for increased accuracy, in less time.

MSC.Nastran Acoustics also supports superelements where the fluid volume is defined as one superelement and the structure can be composed of several superelements.

**Why Use MSC.Nastran Acoustics?**

MSC.Nastran automobile models typically containing millions of shell elements and hundreds of thousands of fluid elements. MSC.Nastran Acoustics offers a more accurate coupling matrix, a faster coupling algorithm, and specific types of results output for acoustics analysis. The MSC.Nastran Acoustics product module quickly determines the fluid-structure interface. The algorithm used insures that rigid body equilibrium is maintained when projecting the fluid pressures to the structure boundary.

Acoustic analysis requires accurate modeling. Often, there are holes in the boundary that need to be addressed. For visualization purposes, an output file (.PCH) is generated that represents the fluid “skin”, which allows the fluid interface or the structure boundary to be inspected for completeness of “skin” coverage.

**Fluid-Structure Interaction**

Acoustic modeling and analysis are multidisciplinary in nature involving both a structural and fluid representation and related numerical aspects. Acoustic problems are solved by direct resolution of the coupled structural and fluid response of the finite model and modal reduction procedures using eigenmodes of the elementary subsystems. The MSC.Nastran Acoustics product module calculates fluid-structure modal participation factor calculations are available for structure, fluid, and panels.

**Random Frequency Analysis**

Random frequency analysis is possible with the MSC.Nastran Acoustics product module to study the affects of random vibration on acoustic performance. Previously calculated frequency responses are used to create random combinations and scaled summations of the structural response. Fluid and structural responses are combined by the RMS method for an average pressure at fluid and structure points to obtain the total energy measure at a particular point, for example, the human ear.

For enhanced results postprocessing, OUTPUT2 (.OP2) or XDB files can be generation for import into MSC.Patran, MSC.Sofy or other pre- and postprocessing programs.

**EXTEND YOUR INVESTMENT**

MSC.Software recommends MSC.Patran™ or MSC.SOFY™ for an integrated modeling and analysis environment.

MSC.MasterKey™ delivers a flexible, token-based licensing system that provides access to the breadth and depth of MSC.Software’s world-class Virtual Product Development software portfolio, allowing you to use whatever simulation tools you want, whenever you need them – maximizing your productivity and reducing cost.

**MAXIMIZE YOUR RETURN ON INVESTMENT**

MSC.Software provides the most comprehensive training, support, and professional services with offices worldwide to provide local and centralized support. Investing in MSC.Software gives you access to extensive client support through comprehensive documentation, direct technical expertise, and customized onsite and offsite training classes taught by experienced engineers.