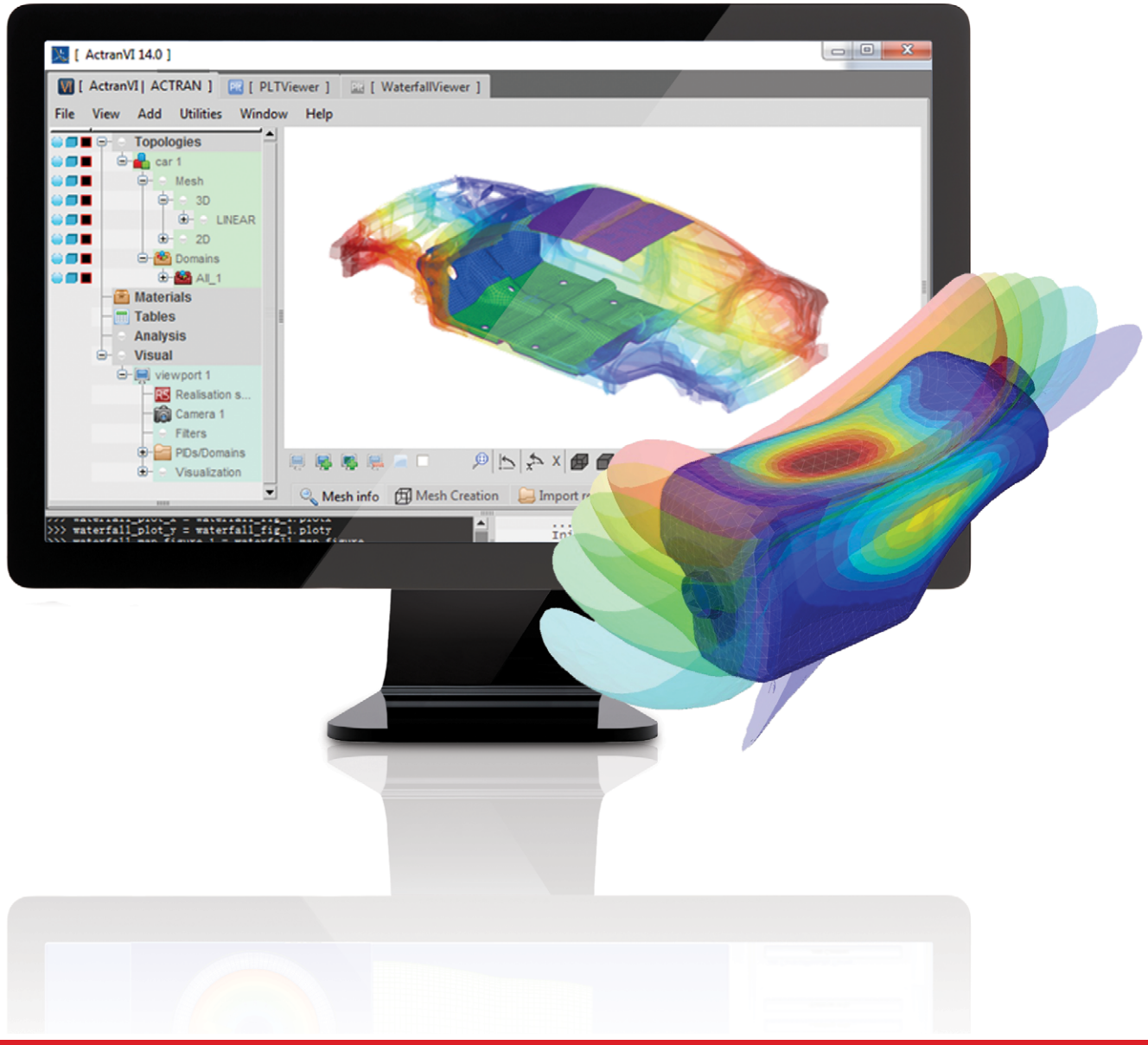
Actran™

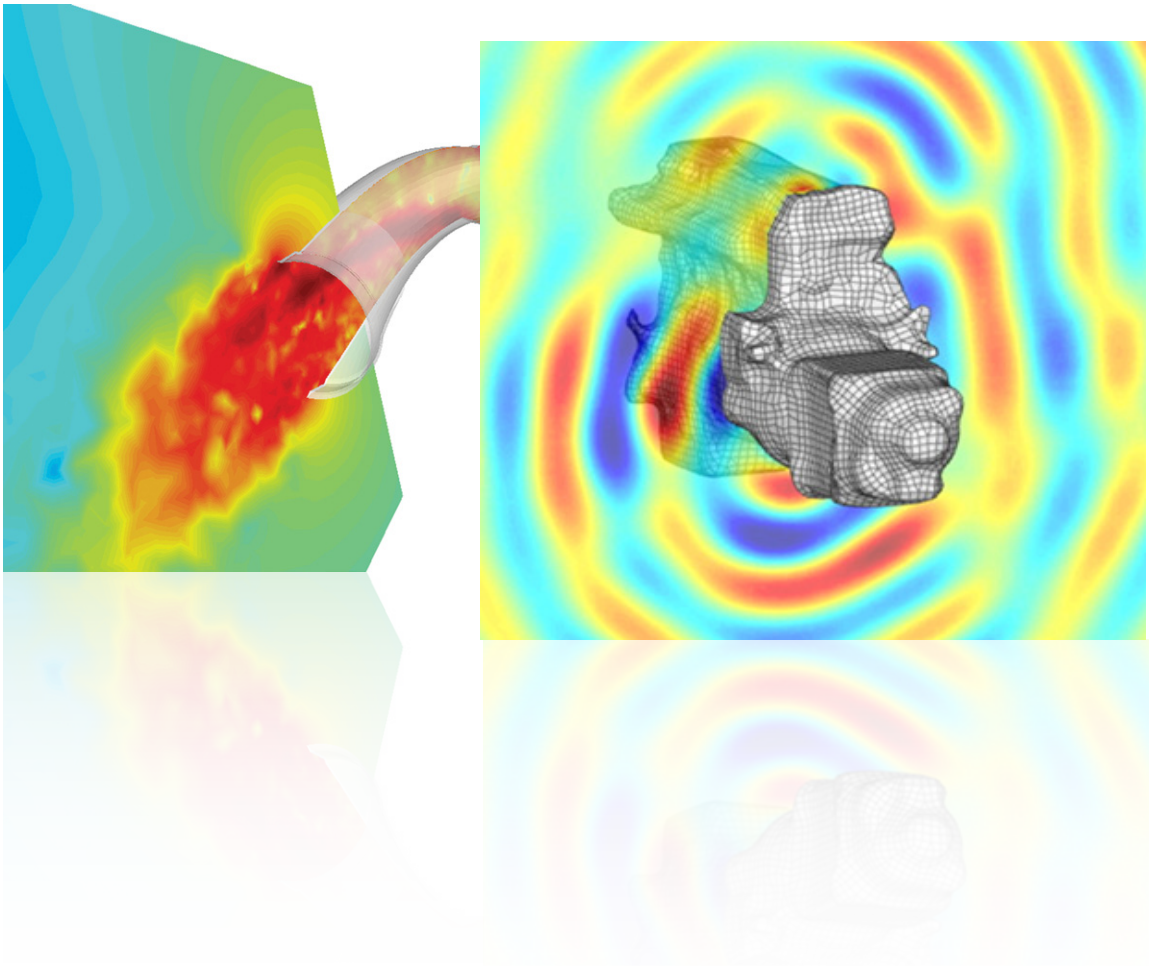
Powerful Acoustic Simulation Software



MSC Software®

Superior Acoustic Performance

Actran is a premier software solution for simulating acoustics, vibro-acoustics and aero-acoustics easily, quickly and accurately. Empowered by the technologies of finite/infinite element methods (FE/IFE), as well as the Discontinuous Galerkin Method (DGM), Actran provides a rich library of materials, elements, boundary conditions, solution schemes and solvers. With the high performance solution coupled with easy to use modeling environment, engineers can gain insight into the acoustic behavior of their products and improve designs early in the product development cycle.



Why Choose Actran

Broad Range of Applications

With its broad range of acoustic analysis capabilities, Actran is used by diverse customers like automotive manufacturers and suppliers, civil and military aircraft and aircraft engine manufacturers, and consumer product manufacturers including loudspeakers and audio device producers. With its rich elements and analysis capabilities, users can simulate not only standard acoustic problems such as exterior acoustic radiation, interior resonation or vibro-acoustic transmission, but also particular problems such as sound wave propagation in narrow ducts or thin cavities, where crucial acoustic phenomena must be faithfully simulated for the design of hearing aid devices or satellite solar array panels.

Robustness

Actran contains a wide set of acoustic modeling features supported by its robust and reliable acoustic finite and infinite element library. Whether you are analyzing interior or exterior acoustic problems, modeling the transmission through flexible walls or predicting the absorption by a porous medium, you can easily accomplish the task with Actran, which offers both modal and physical approaches and multiple material models. Through its seamless interface with most finite element structural analysis solvers like MSC Nastran, you can also solve sound radiation problems with improved accuracy.

Modular

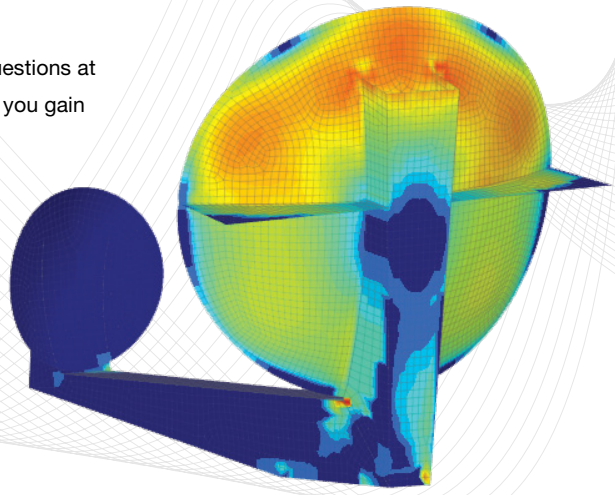
Actran is packaged to suit your specific analysis requirements. You can get started with the foundation module of Actran Acoustics, which provides a wide set of acoustic analysis capabilities. For specific advanced analysis requirements, you can choose to add specific modules to reach higher level of complexity of the simulated physics.

Superior Performance

By taking advantage of Actran's superior solvers and parallel processing capabilities, users can solve bigger problems faster. The automation capability by scripting allows running more design iterations in shorter time. Engineers can now improve time to market for their products with increased confidence in the designs.

Outstanding Support

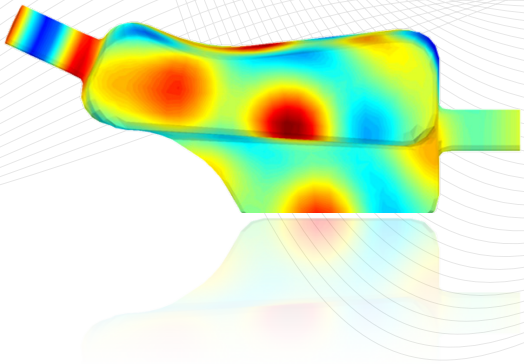
Backed by world-wide support, you can be confident to get answers to your questions at all stages of software usage. Our highly proficient services teams can also help you gain the most out of the software through customized training, consulting services, methodology development and product customization.



Actran Acoustics

Robust Solution for all your Acoustic Analysis Needs

Actran Acoustics is the foundation module of the Actran family and offers a wide set of acoustic analysis capabilities to help you simulate your complex systems.



"Actran helps further improve how we investigate and understand acoustic challenges in order to ensure that we continue to provide leading-edge acoustic solutions for exhaust systems."

Jerome Voillequin,
Tenneco Emission Control Europe,
Germany

Rich Material Library

- Model acoustic fluid accurately
- Simulate visco-thermal acoustics to account for damping mechanisms occurring in thin acoustic layer and narrow tubes (or channels)
- Analyze absorption occurring in foams or rock wools with "fluid equivalent" types of porous material formulations (rigid porous, lumped porous, Delany-Bazley porous, Miki porous)

Comprehensive Element Library:

- Model with linear and quadratic elements
- Perform 2D, 3D and axi-symmetric analyses
- Simulate acoustic radiation in free field with infinite elements, or adaptive perfectly matched layers

Rich Set of Boundary Conditions, Operating Conditions and Sources

- Various acoustic sources - plane, spherical and cylindrical wave sources
- Apply realistic boundary conditions of pressure, velocity, acceleration and admittance
- Apply excitation of ducts by incident plane waves
- Retrieve vibration results from MSC Nastran (or other FEA solvers)\ for sound radiation analysis
- Convected acoustics in a mean flow

Multiple Solution Strategies

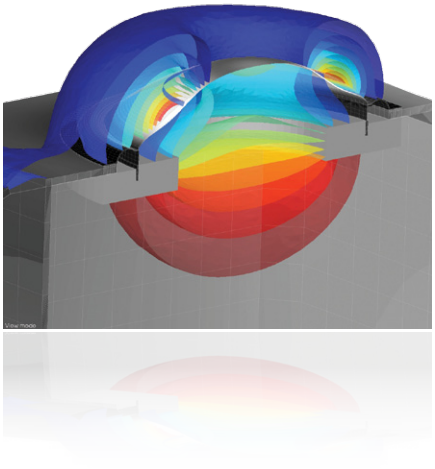
- Extract cavity acoustic modes
- Direct response in physical coordinates or modal superposition approach
- Apply multiple loads
- Restart your analyses for multi-step problems
- Achieve performance with in-core and out-of-core solvers supporting sequential and parallel (Shared and Distributed) computer architectures
- Obtain fast frequency response using Krylov solver

Applications

- Sound radiation by vibrating structures: powertrain, engine components, compressors and more
- Sound produced by pulse signals: golf club, watch repeater, etc.
- Intake and exhaust noise including air filter, complex mufflers, catalytic converters, etc.
- Air conditioning units and distribution systems
- Sound absorption inside passenger compartment of cars, trains and aircrafts
- Audio devices such as telephones, hearing aids or musical instruments

Actran VibroAcoustics

Complete and Robust Solution for Vibro-acoustic Analysis



"We have verified the ability of Actran to solve vibro-acoustic problems with a wide variety of physics, & continue to advance our capability thanks to Actran's efficient solver capabilities which allow us to analyze larger and more sophisticated models. This has given us a competitive advantage and stronger relationships with our customers."

Chris Carter,
Frazer-Nash Consultancy

Broad Range of Materials

- Model bulk reacting materials with poro-elastic element library based on the BIOT theory
- Analyze visco-elastic structures
- Model active structures with piezoelectric materials
- Simulate complex multilayered structures with composites material models

Realistic Loading Conditions

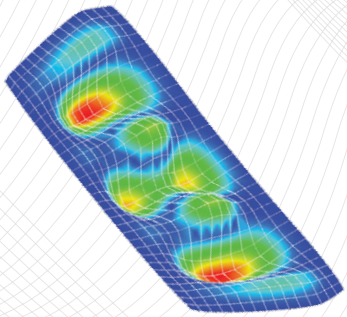
- Combine acoustic, dynamic and kinematic boundary conditions
- Simulate real-life excitations like diffuse sound field, turbulent boundary layer or rain-on-the-roof
- Import aero-dynamic excitations from most CFD solvers
- Couple aero-acoustics features to model aero-vibro-acoustics
- Utilize physical, modal or hybrid modal-physical approaches
- Choose between direct and iterative solvers
- Improve performance with staggered solution scheme
- Unique fast FRF synthesis solver (Krylov)
- Improve productivity with parallel solvers

Nastran to Actran Translator

- Translate a Nastran structural model to an equivalent Actran model
- Enrich the translated Actran model to vibro-acoustic analysis, (e.g., including porous material, exterior acoustic radiation, etc.)

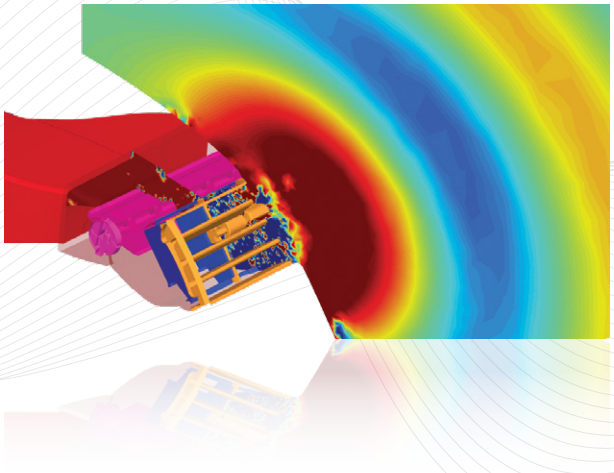
Applications

- Automotive: noise problems from power trains, intake & exhaust, passenger cabin, trim, seats, hoses, tires, windows and window shields, audio, active noise control.
- Aerospace: sound transmission through cockpit and fuselage, noise propagation in air distribution system, response to TBL excitation, random dynamic response of rocket payload at take-off
- Consumer goods: telephones, headsets, loudspeakers, hearing aid devices, disk drives, washing machines, refrigerators, cameras
- Defense: underwater acoustics, sonars



Actran AeroAcoustics

Predict the Noise Generated by Complex and Turbulent Flows



Implementing acoustic analogies into FEM, Actran AeroAcoustics offers high performance solvers and parallel processing features and can be combined with Actran VibroAcoustics to address aero-vibroacoustic challenges.

Hybrid Approach

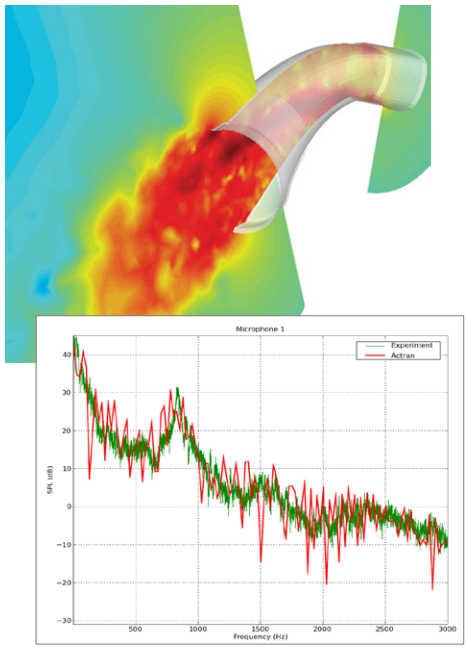
- Compute aerodynamic noise sources from transient flow simulations performed with CFD codes such as Fluent, StarCCM+, OpenFOAM, PowerFLOW, etc.
- Translate CFD results from time to frequency domain
- Map CFD results to acoustic mesh using integration method
- Generate acoustic sources using Lighthill's and Möhring's acoustic analogies

Key Features

- Inherit all the features from the Actran Acoustics module
- Interface with leading CFD codes using native CFD file formats, or through Ensight Gold format
- Achieve high performance with direct and iterative solvers and parallel processing capabilities
- Fan noise prediction based on compressible CFD solution or on less costly CFD solutions such as MRF & NLH
- Address your aero-vibro-acoustic challenges with compatible vibroacoustic features

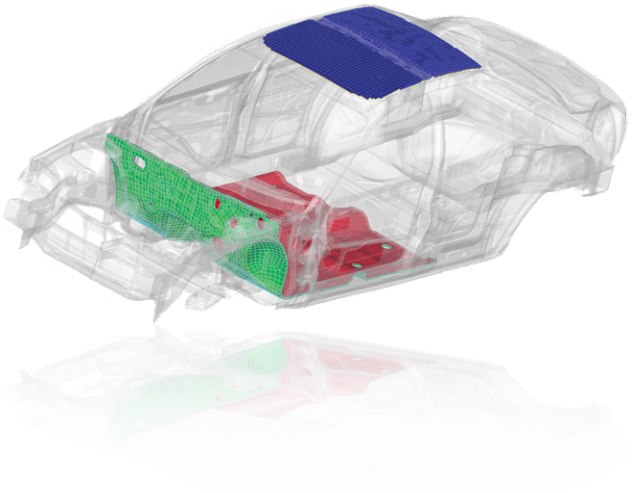
Applications

- Air conditioning modules (HVAC)
- Car side mirror noise
- Fan noise
- Airframe noise (landing gear, trailing edge)
- Air distribution systems



Actran for Nastran

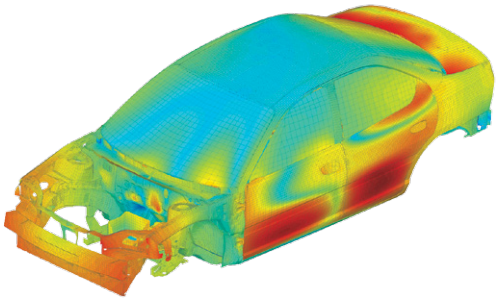
Combine the strengths of Actran and Nastran to predict the response of a trimmed vehicle body



Actran for Nastran provides CAE engineers advanced features for mixing the best of both worlds for trimmed body simulations: an MSC Nastran modal representation of the body and an Actran physical representation for the trim components.

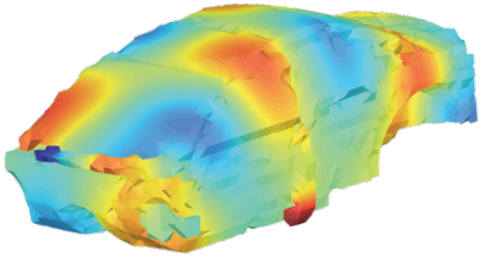
Accurate Trim Modeling

- Utilize poro-elastic element library based on the Biot theory to model porous materials
- Utilize visco-elastic element library to model elastic shells or heavy layers
- Define acoustic elements for modeling air-gaps



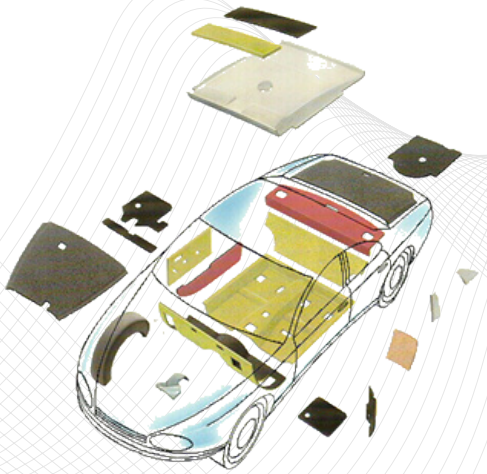
Efficient Structural-Acoustic Coupling

- Merge Actran models of individual trim components with MSC Nastran body-in-white model to create a fully trimmed body vibro-acoustic model
- Connect Actran model to MSC Nastran model for real-world simulations
- Enrich MSC Nastran model by exporting Actran components using DMIG data blocks
- Import MSC Nastran superelements into Actran



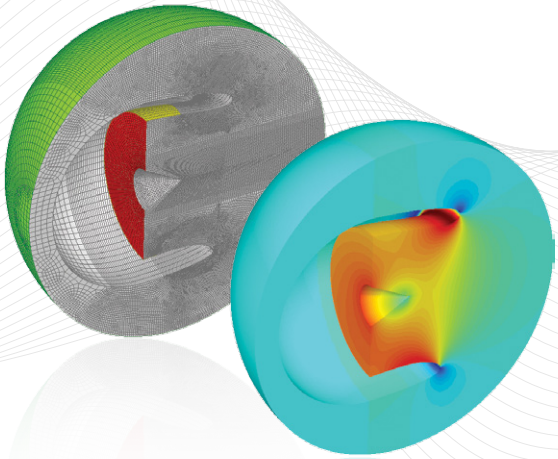
Applications

- Acoustic transmission through components in real-life mounting conditions
- Trimmed body modeling using a combination of Actran detailed models in physical coordinates and a Nastran body-in-white modal model



Actran TM

Powerful Acoustic Solution for Turbomachinery Noise Prediction



"Actran has helped Airbus design and deliver best-in-class acoustic solutions that save aircraft weight with a huge financial impact for airlines operating Airbus aircraft."

Jean-Yves Suratteau,
Head of Numerical Methods,
Acoustics & Environment
Department at Airbus

Comprehensive Solution

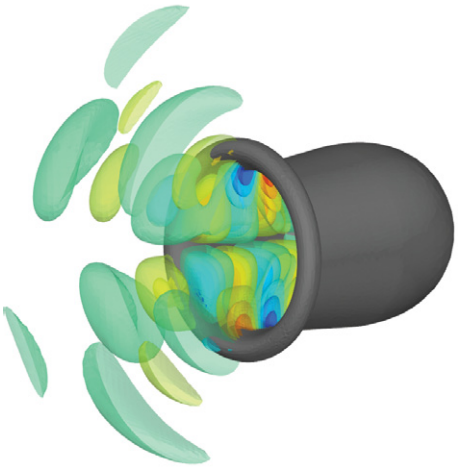
- Analyze acoustic propagation and radiation taking into account a non-uniform mean flow
- Model liners accurately including the flow effects (Myers-Eversman formulation)
- Perform harmonic analysis
- Integrated compressible flow solver for mean flow calculation
- Import mean flow with streamlined interface with leading CFD tools, including Fluent™, STAR-CD™ and PowerFlow™
- Model turbofan using a decomposition of incident analytical or numerical spinning duct modes
- High performance solvers and parallel computation capabilities to deal with massive size problems at high BPF's
- Complement your analysis by Actran DGM to solve problems involving complex shear layers and flow gradients at the engine exhaust

Choice of Elements

- Utilize infinite elements for unbounded domains
- Perform 2D, axisymmetric and 3D analysis
- Model accurately with a complete finite element library

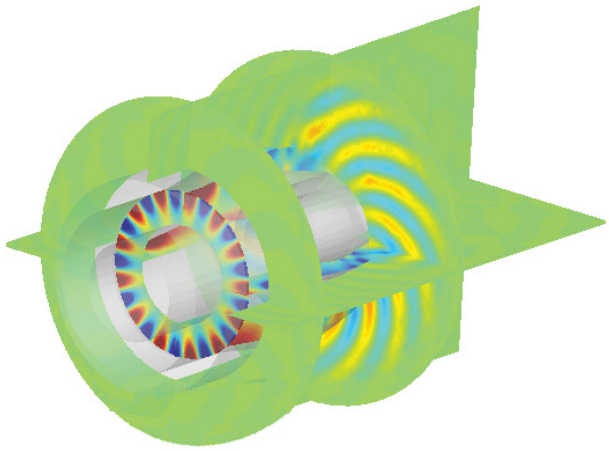
Applications

- Aircraft engine noise, including nacelle design
- Helicopter turbine noise
- Ducted cooling systems (electronic devices)



Actran DGM

Model Noise Propagation in Complex Flows



With its unstructured meshing method, elements are automatically adapted allowing for a non-homogenous mesh without any performance degradation.

"Actran is the only simulation tool able to model the main physical phenomena for engines nacelle radiation."

Jean-Yves Suratteau,
Head of Numerical Methods,
Acoustics & Environment
Department at Airbus

Efficient Solution

- Predict noise propagation in complex physical conditions
- Solve linearized Euler equations using discontinuous elements
- Set up and analyze 2D, axisymmetric and 3D models
- Analyze your models with a time domain solver

Meshing for Performance

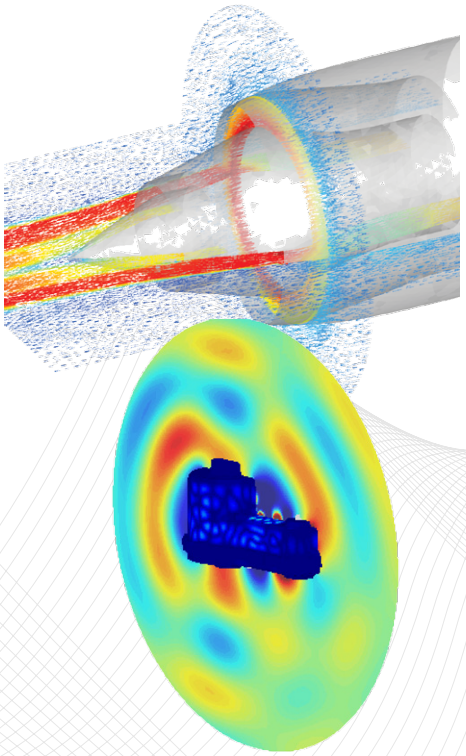
- Model using unstructured mesh that overcomes standard constraints of a Finite Difference mesh
- Get accurate results with automatic adaption of the elements, without performance degradation
- Reuse mesh for frequencies of ratio 1 to 4 to save you modeling effort
- Achieve high parallel scalability with discontinuous spatial scheme

Extensive set of features

- Decompose engine excitation in duct modes
- Model non-reflective boundary conditions with absorbing buffer zones
- Model liners using a time-domain translation of the Myers BC
- Simulate sound radiation from large vibrating structure (with structure vibration calculated using FEA solver)

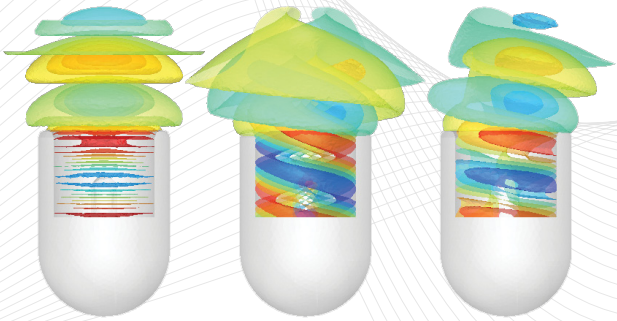
Applications

- Exhaust of turbomachines
- Inlet of large turbomachines
- Acoustic propagation problems with non-homogenous mean flow conditions
- Sound radiation from large vibrating structure



Actran VI

Dedicated pre- and post-processor for Actran



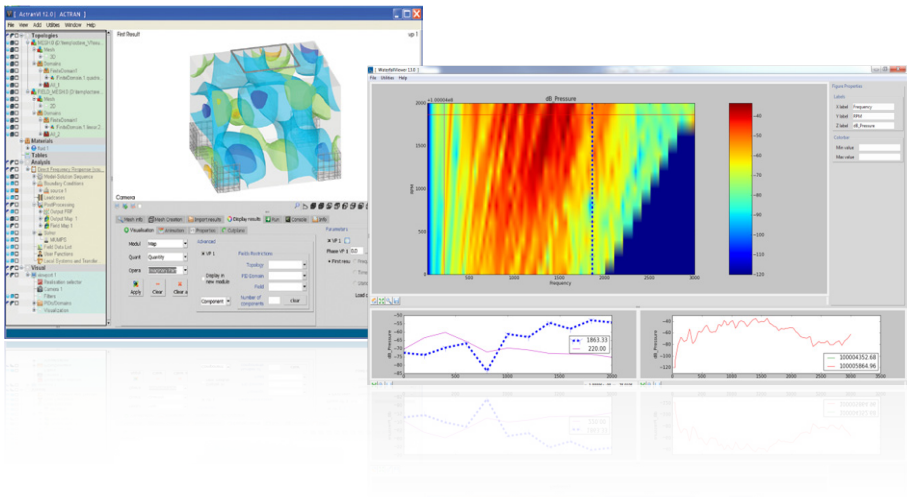
Actran VI supports all the Actran features for creation and editing of acoustic models. The input file reader helps you check and modify input files generated by other tools.

Powerful and Flexible

- Support of all Actran features for the creation and editing of Actran analyses
- Support of different mesh formats such as BDF (MSC Nastran), OP2 (MSC Nastran), UNV, RST (Ansys), CDB (Ansys), NFF & DAT (Actran) and Patran Neutral Format
- Support of different results formats such as OP2, UNV, NFF, RST, HDF and Punch
- Reading Nastran structure analysis, translate and enrich into Actran vibro-acoustic analysis
- Translate Nastran structure analysis into Actran analysis, and enrich it with acoustic features
- Automate your computational chain through the use of the powerful API to improve your design process

User-friendly Interface

- Visualization of the projection quality for incompatible meshes
- Visualization of acoustic meshing quality
- Synchronized viewports for results and analyses comparison
- PLTViewer and WaterfallViewer tool for easy display and handling of frequency response functions
- Contour plots, iso-surfaces, vectors and deformations features responding to the specific requirements of the acoustics community
- Multiple cut-plane filters for visualizing results within a mesh
- Animation module dedicated to complex harmonic and transient results
- Video export from map results
- Convert Frequency response to audio file



MSC Products

Simulating Reality, Delivering Certainty

Integrated Solutions

Adams

Multibody Dynamics Simulation

Actran

Powerful Acoustic Simulation Software

Easy5

Advanced Controls Simulation

Marc

Advanced Nonlinear & Multiphysics

SimXpert

Multidiscipline Simulation

Solver Solutions

MSC Nastran

Structural & Multidiscipline

Dytran

Explicit Nonlinear & Fluid Structure Interaction

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Fatigue Simulation

Sinda

Advanced Thermal

Mid-Sized Business Solutions

FEA, AFEA, TFEA

Structural, Nonlinear, Thermal Simulation Bundles

MSC Nastran Desktop

Multidiscipline Simulation for the Desktop

SimDesigner

CAD-Embedded Multidiscipline Simulation

Modeling Solutions

Patran

FE Modeling and Pre/Post Processing

SimXpert

Multidiscipline Simulation Environment

Simulation Data & Process Management

SimManager

Simulation Data and Process Management

Actran™

Powerful Acoustic Simulation Software

MSC Software is one of the ten original software companies and the worldwide leader in multidiscipline simulation. As a trusted partner, MSC Software helps companies improve quality, save time and reduce costs associated with design and test of manufactured products. Academic institutions, researchers, and students employ MSC technology to expand individual knowledge as well as expand the horizon of simulation. MSC Software employs professionals in 20 countries.

For additional information about MSC Software's products and services, please visit: **www.mscsoftware.com.**

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