

Acoustic Simulation for Spacecraft Launch

Prevent Structure Failure through Simulation

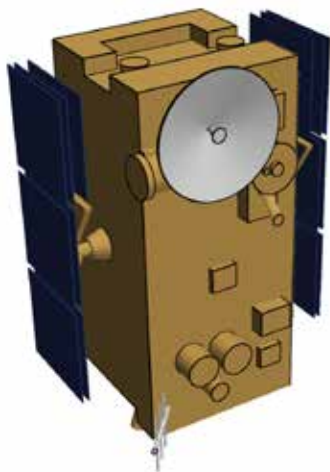
Design Challenge

At lift-off, launcher structure and payload components such as satellites or antennas are exposed to intense acoustic loading that can damage their structure. Any minute detail that disrupts the structure during lift-off could result in a catastrophe.

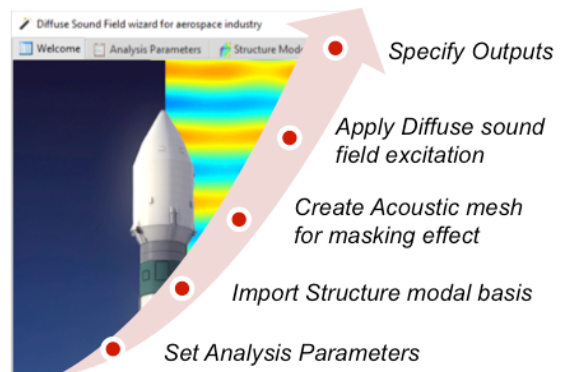
Actran is a simulation tool that allows for the accurate prediction of the vibro-acoustic response of structures subjected to intense acoustic loads. Thanks to its advanced modelling capabilities and intuitive user interface, Actran provides users with a complete set of tools to optimize the structure design in a fast and robust way to ensure for a successful launch. For any additional information regarding this application, please contact info@fft.be.

Process for Spacecraft Launch Vehicle Vibro-Acoustics with Actran

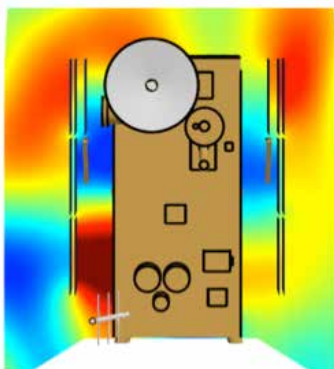
1 Import Structure Mesh and Normal Modes from MSC Nastran



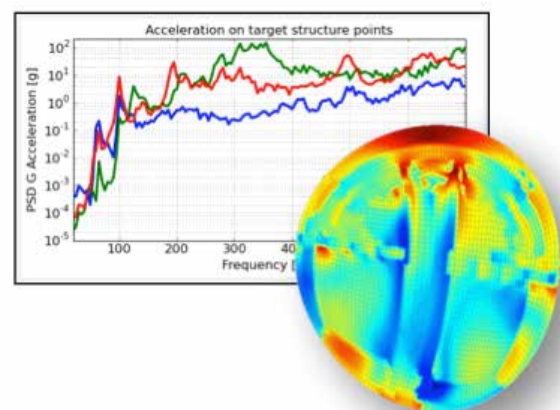
2 Let Actran Guide you through model pre-processing



3 Compute the Vibro-acoustic Response Including Strong Fluid-structure Coupling and Masking Effect



4 Access Advanced Post-Processing Indicators



Benefits of predicting the Vibro-Acoustic Performance of your Space Structures with Actran

Reduce the Development Time and Cost

Significantly reduce the need for physical prototypes and tests by performing vibro-acoustic simulations with Actran. Account for vibro-acoustic constraints earlier in your design process and conduct virtual tests.

Integrate Actran into your Existing CAE Process

Extend your certified Nastran structural models to account for advanced acoustic phenomena: Import structure modal representation from Nastran, complete it with advanced acoustic components (honeycomb, porous or perforated structures), and compute the vibro-acoustic response including strong fluid-structure coupling.

Use the Dedicated Space Launch Acoustic Wizard

Easily create a hybrid frequency response model (modal structure and physical acoustic component) through the dedicated pre-processing wizard.

Model Acoustic Excitations Accurately and Efficiently

Apply random acoustic excitation to your structure to represent launch acoustic loading. Use efficient implementations of Diffuse Sound Field (DSF) and Turbulent Boundary Layer (TBL) excitations to account for masking effect.

Gain in-depth Understanding of Structure Behavior and Acoustic Fatigue

Evaluate the vibro-acoustic response of the structure with a large variety of post-processing indicators (stress, acceleration, energy levels...). Use Actran results to assess the acoustic fatigue of your structure.

Evaluate the Robustness of Structure Design

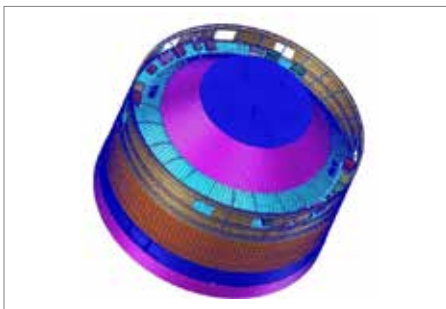
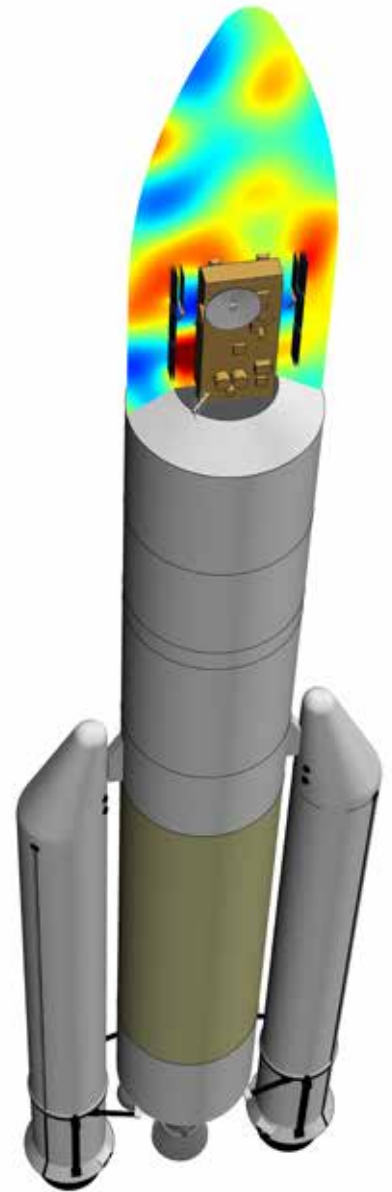
Apply the Non Parametric Variability Method (NPVM) to assess how sensitive your structure is to manufacturing or modelling uncertainties. Gain confidence in your numerical predictions and build fewer prototypes to validate your design.

Run Fast Simulations

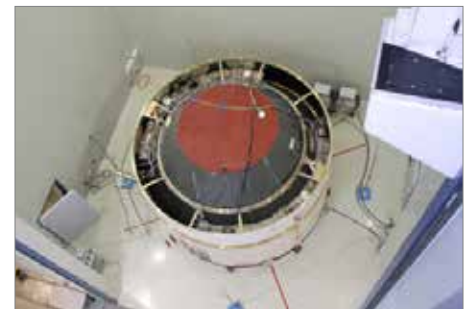
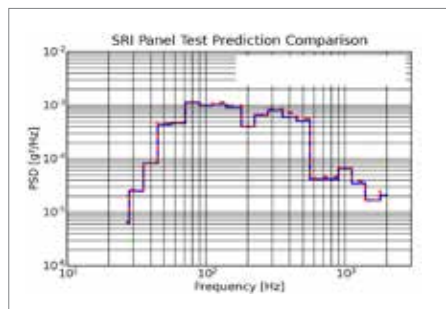
Enhanced performant algebraic solvers, efficient implementations, and HPC to solve large models and large frequency ranges in a short time frame allowing for multiple design iterations. Automate any step of the model pre-processing, run, and post-processing thanks to Actran's extensive scripting capabilities.

Trusted Solution for the Space Industry

Actran is a commercial finite element code designed specifically for simulating acoustics, vibro-acoustics, and aero-acoustics. It has been extensively validated and can be used to accurately model structural vibrations, fluid structure interactions, and turbulence noise propagation.



Equipment bay structure model



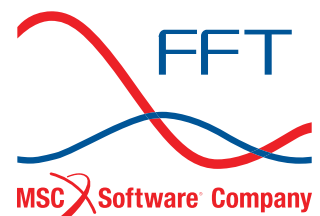
Acoustic loading test setup

K.Abdoly et al. (2011). Prediction of Vibro-Acoustic Responses of ARIANE 5 Vehicle Equipment Bay due to Acoustic Noise Excitation. ECSSMET

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