

MSC Nastran and AVL EXCITE™ Integration Delivers

Better, Faster and More Efficient Powertrain Simulations

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Originally developed for NASA engineers, MSC Nastran is the most trusted FEA solver for design and analysis of aerospace and automotive structures. Industries have commonly used the proven solutions of MSC Nastran for the past 50 years. To build upon the same practice, MSC Nastran provides streamlined workflows for powertrain simulations, improved verification options for contact models and enhanced HPC methods for simulation of large-scale problems.

Through a direct coupling between MSC Nastran and the AVL EXCITE, engineers can perform the analysis of dynamics and acoustics of powertrain systems faster and more accurate.

AVL EXCITE is a multi-body dynamic simulation software that provides rigid and flexible solutions for the analysis of powertrain systems. The robust solutions of AVL EXCITE family are equipped with advanced technology to calculate dynamics, strength, vibration, and acoustics of conventional and electrified powertrains. Engineers can create accurate models that account for all physical properties of materials and lubricants to predict contact behavior, friction, and wear in slider bearings, pistons, piston rings and gears.

With the new direct coupling, AVL EXCITE can now be used with MSC Nastran to increase the accuracy of Multi-Body simulations by providing a better representation of the flexible components. Similarly, the FEA engineers can benefit from this integration to examine each component with realistic boundary conditions and dynamic loads. Direct export of AVL EXCITE input (.EXB) files from MSC Nastran makes data transfer much easier and faster, eliminating the need for creating and translating extensive intermediate data.

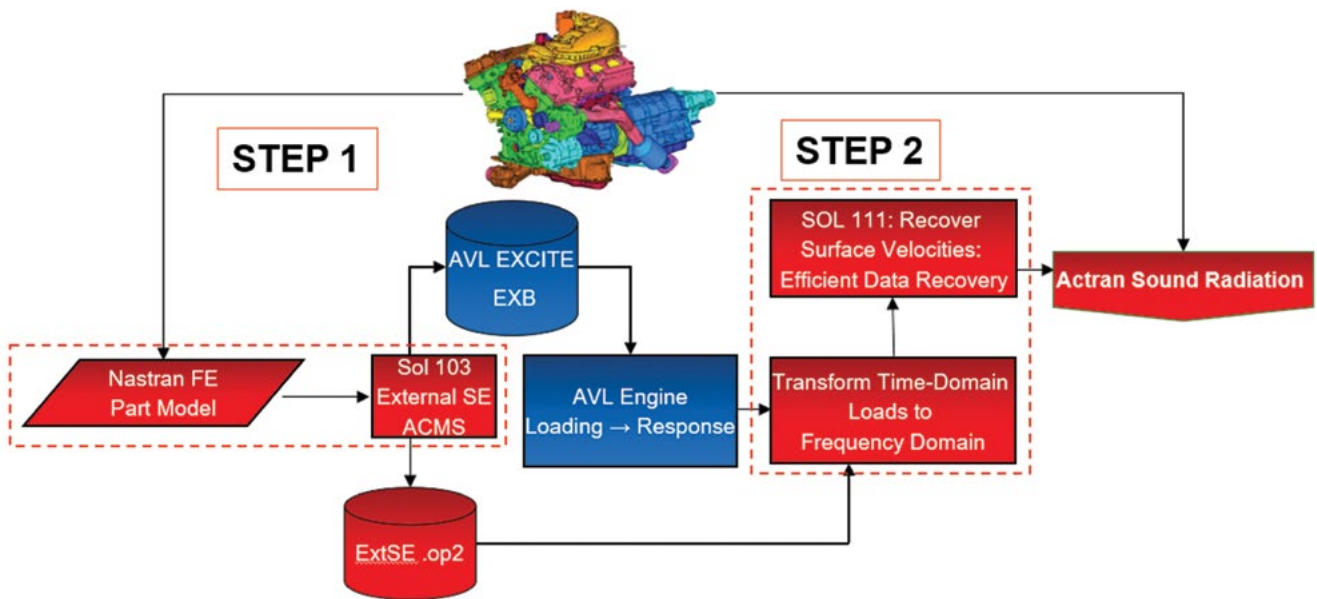


Figure 1: MSC Nastran SOL 103 to AVL Excite to SOL 111 Workflow

The workflow allows engineers to obtain a full characterization of structural response by leveraging the nonlinear solution of MSC Nastran (SOL 400) to include contact nonlinearities as well as preloaded conditions in their powertrain simulations. Additionally, MSC Nastran can read back output results from AVL EXCITE for further dynamic and acoustic analysis of sound radiations generated from Internal Combustion Engines and other components. This technology is also beneficial for vehicle durability simulations, taking advantage of the award-winning embedded fatigue capabilities of MSC Nastran to obtain fatigue life and damage responses of components.

This functionality will be of benefit to the automotive industry by providing the analyst that uses MSC Nastran and AVL EXCITE™ and workflow to perform various analysis (like dynamic, vibrational, acoustical) - a direct, convenient and efficient method to exchange data.

The enhanced MSC Nastran-AVL EXCITE™ Interface with MSC Nastran has multiple advantages over the currently used DMAP alters method:

1. **Direct:** Creation of EXB file from MSC Nastran rather than exporting

multiple op2/op4 files from MSC Nastran which are converted by another standalone proprietary program into an EXB file.

2. **Simple:** Only two files are created during step-1 (EXB and external superelement op2) as opposed to multiple op2/op4 files (GEOMUNIT, EIGNUNIT, PSTUNIT, GPSRUNIT, MKAAUNIT, MFFUNIT, TRANUNIT).
3. **Fast:** For step-1, shared memory parallelization (SMP) would be enabled to make the calculation of computationally intensive higher order mass invariants faster. For step-2, EXTSEOUT feature is leveraged to minimize data storage and enable efficient data recovery in MSC Nastran.
4. **Convenient:** Allows for quick export of EXB file to AVL and quick import of AVL results back into MSC Nastran.

The direct, efficient, fast, and convenient method to exchange data between the two solvers enables significant time savings, resulting in up to 3x performance gain for analysis of powertrains and engine systems.

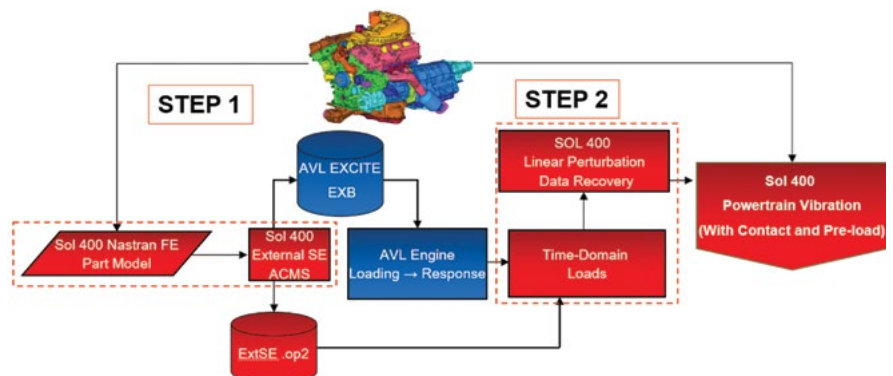


Figure 2: MSC Nastran SOL 400 to AVL Excite to SOL 400 Workflow