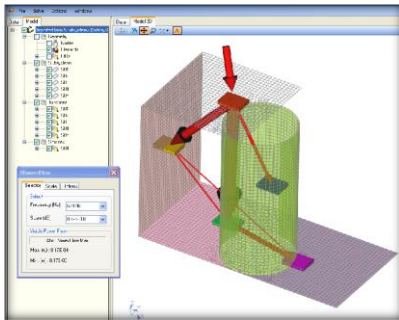


## Predictive Solution for Noise and Vibration Design in Medium and High Frequencies Domain

SEA+ is object-oriented Software for engineers to predict Noise and Vibration (N&V) design process. SEA+ is a breakthrough in Energy Flow N&V analysis based on the SEA method (Statistical Energy Analysis).



Wide-ranging applications include:

- Automobile interior acoustic design
- Air- & rotor -craft interior noise control
- Rocket & spacecraft vibroacoustics
- Railcar interior & railway structure noise
- Shipboard and underwater noise
- Architectural acoustics
- Consumer appliance noise control

## Modeling & Analyzing

SEA+ models are managed in a 3D graphical user-interface (GUI). From this, vibroacoustic interactions are modeled in a fast and easy way.

SEA+ incorporates an extended library of analytical subsystems (structures and acoustic cavities), cross-coupled through various connections such as structural radiation, mass law, leakage, isolators...

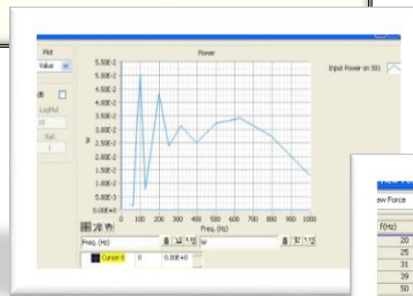
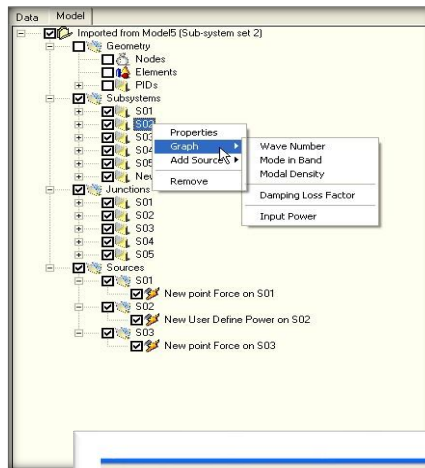
SEA+ abstract model representation makes SEA+ very handy at design stage, as no geometrical detail is required.

SEA+ visualizes power flows and energy drops from source to receivers thanks to its 3D GUI, allowing quick hierarchy of transfer paths.

Furthermore, SEA+ creates Virtual SEA (VSEA) models from NASTRAN FEM thanks to SEAVirt Module. Any VSEA model can be coupled with any other analytical SEA+ subsystems, reducing analysis time in both FEM and SEA domains while increasing accuracy.

## Relational Database

SEA+ is based on a fast relational database engine allowing the storage of very large models of more than 1 Tb.



## Prediction of Sound Transmission of Multi-layered System

Thanks to its implementation of Transfer Matrix Method (TMM), acoustic trims are efficiently modeled as combination of poroelastic, septum, thin or thick plate perforated or not, fiber or fluid layers and linked to SEA subsystems describing the flanking transmission.

Noise insulation properties of industrial acoustic systems are reliably predicted and optimized (acoustic transmission through aircraft fuselage, trimmed car body, insulation panels, building walls, double-glazing windows...).

\*SEA-TEST and SEA-XP are InterAC software, more information on web site: [www.interac.fr](http://www.interac.fr)

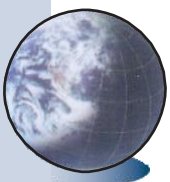
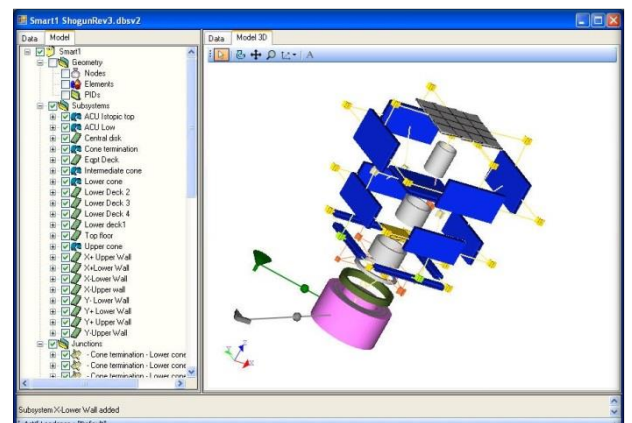
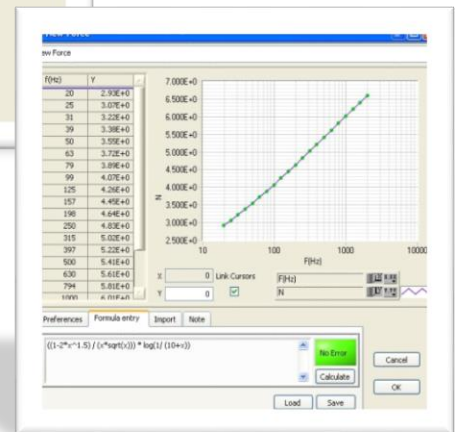
SEAWOOD is a dedicated version of SEA+ for wood building industry with restricted mathematical libraries mostly limited to planar construction.

## Importing User Data

External spectra or parameters are imported in SEA+ and any SEA quantity can be user-defined.

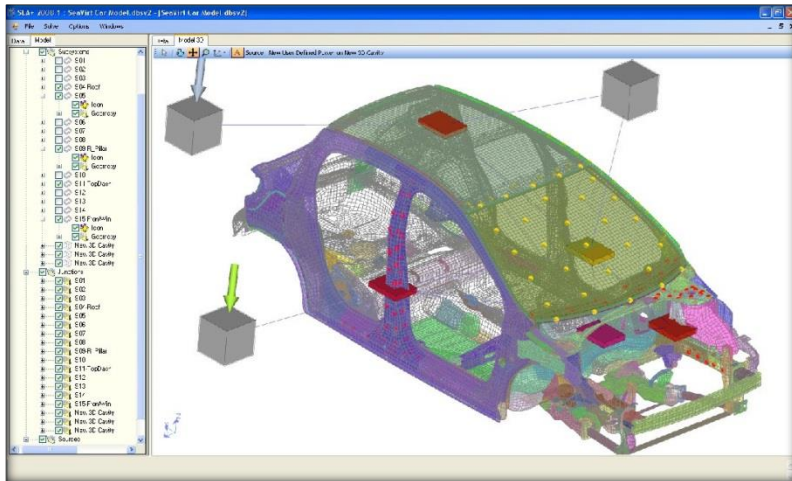
Experimental SEA data from software SEA-XP\* or SEA-TEST\* are also imported in SEA+ subsystems and coupled with virtual and analytical subsystems to build hybrid models.

User-defined acoustic transmission models are created from imported Transmission Loss and Insertion Loss spectra.



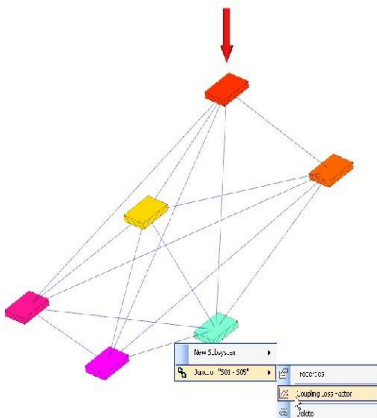
## SEA+ for Vibroacoustic Prediction

SEA+ is predictive software for vibroacoustic applications. With SEA+, SEA network are interactively created to predict transmission paths, acoustic pressure and vibrations of coupled dynamical systems such as acoustic cavities and shells over a wide frequency range.



## Analytical Subsystem Library

SEA+ incorporates a library of subsystems to predict wave numbers, modal densities and CLF of a wide range of structures (beams, plates, shells). Structural subsystems are orthotropic, sandwich or ribbed. All subsystems are supporting 3-wave types, junctions are point or line-connected with soft-joint insertion for vibratory insulation. Full support for heavy fluid loading.



## Library of Sources

Force, diffuse acoustic pressure, injected power, constrained velocity, acceleration or pressure can be applied to subsystems to represent physical excitations.

## SEA+ and Virtual SEA with SEAVirt (SEA+ Optional Module)

VSEA model is directly opened in SEA+ and can be coupled with any subsystem of the analytical library.

## 3D GUI for Fast Model Construction

SEA+ models are built in a 3D scene allowing multiple views of the model. Subsystems are represented as 3D Icons or Geometry Shapes. If a geometry file (NASTRAN) is available, it can be imported in the 3D scene to improve visibility.

Copy & paste is available for all graphical elements and their related spectra in the internal database. All operations are driven by contextual local menus.

## Post-processing of Results and Visualization

Results are stored in the database as spectrum. Multiple plots, copy & paste of data and export to spreadsheet are available in 2D graph windows. Energy flow between subsystems and thermograms are 3D plots allowing transmission path visualization between subsystems.

## Database of Spectra

The database includes the following spectrum types:

- Absorption coefficient
- Acoustic pressure
- Acceleration
- Coupling Loss Factor (CLF)
- Damping Loss Factor (DLF)
- Ebinaur transfers
- Energy
- Force
- Impedance
- Mass
- Modal density
- Narrow-band
- Power
- Velocity
- Wavenumber

## Acoustic Insulation with SEA-Foam & SEA-Cyl (SEA+ Optional Modules)

A multi-layered flat or curved panel can be modeled by SEA-Foam. SEA-Foam incorporates modeling of porous, fiber, limped foam, septum, perforated plates, thin or thick elastic plates, heavy or light fluid layers. Complex and realistic acoustic multi-layered panels (including structure borne sound transmission) can be built within the 3D GUI of SEA+ with SEA-Foam.

SEA-Cyl (developed by CSTB) is a very efficient spectral approach of cylindrical multilayered systems improving accuracy of acoustic transfers in SEA or Virtual SEA models. It leads to refined physical behavior with quick and robust simulation of any trimmed curved element.

## Shock Transmission with SEA-Shock (SEA+ Optional Module)

With SEA-Shock, the prediction of time history and shock response spectra of very high frequency content allows modeling rocket stage separation, spacecraft separation or shock test. Specific models of shock source are provided: pyrozip, clampband for aerospace applications.

## Minimum Requirements

- Windows 7 to 10
- XGA monitor resolution (1024x748)
- 2 Gb memory

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