SEAVirt Overview

Predictive Solution for Noise and Vibration Design

SEAVirt transforms Finite Element model into SEA model

SEAVirt is optional Module of SEA+ software based on **SEA** method (**S**tatistical **E**nergy **A**nalysis).

SEAVirt Module allows engineers to more effectively interpret **F**inite **E**lement (**FE**) prediction for the **N**oise and **V**ibration (**N&V**) design process. It offers highly optimized data processing of numerical FE data (mode shape and eigen values) and data reduction capabilities to extract parameters used in the Energy Flow N&V design process based on SEA method.

Wide-ranging applications include:

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

Virtual Data Acquisition Process

SEAVirt generates **F**requency **R**esponse **F**unctions (**FRF**) on a grid of user-defined nodes (the observations nodes) from a modal database created by a NASTRAN FE model. Just select in your FE software nodes where to output modal amplitudes, process your FE model and store modal information in a file.

SEAVirt reads FE geometry and modal information and synthesizes all FRF between all nodes at the highest frequency available in your modal set.
SEAVirt generates virtual measurement from your FE model.

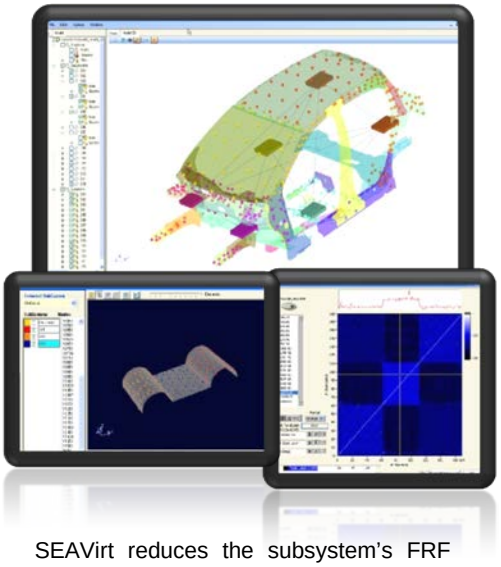
SEAVirt is designed for fast synthesis. For example, a car body requires around 1,000 nodes to be described accurately, which means 1,000,000 FRF to compute.

Extract N&V Parameters

Automatic detection of SEA subsystems

Virtual measurements can be grouped automatically for different structural and acoustic regions - corresponding to the **'subsystems'** of SEA design method.

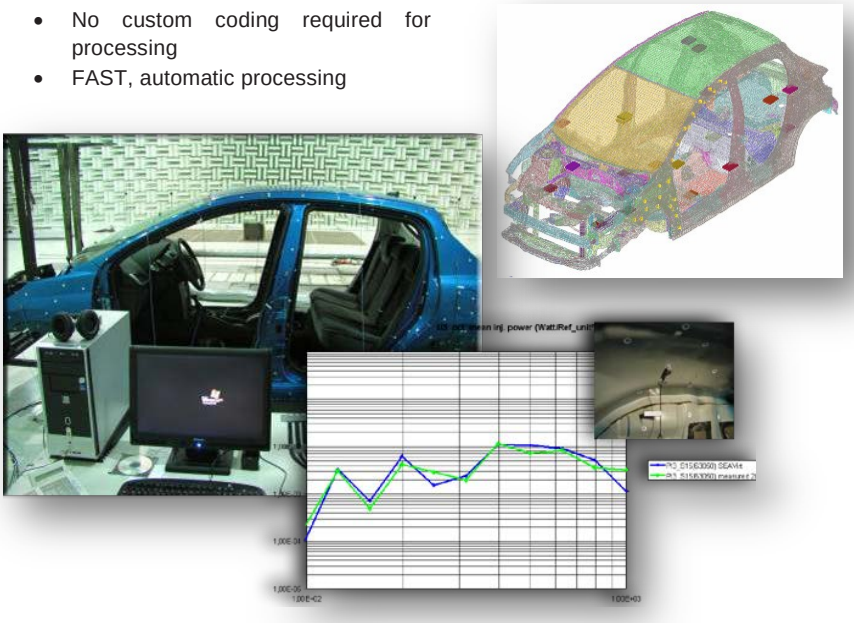
SEAVirt searches for the most efficient **V**irtual **SEA** (**VSEA**) subsystems using fast algorithms based on attractive method.



SEAVirt reduces the subsystem's FRF data to a set of SEA parameters that completely describe how N&V energy will distribute itself in the test specimen.

These parameters are equivalent mass (or acoustic volume), **D**amping **L**oss **F**actor (**DLF**), **C**oupling **L**oss **F**actor (**CLF**), modal density and power level of applied excitation.

- Avoid errors in reducing large datasets
- No custom coding required for processing
- FAST, automatic processing



Virtual SEA Modeling

The reduced data define a mathematically complete SEA model of a test specimen - or even just a part of the specimen.

With this **'Virtual SEA'** (**VSEA**) model, you can predict subsystem N&V levels due to synthesized load cases, conduct 'noise path analysis' diagnostics and determine optimum damping for noise control.

Other applications include the identification of a load or environment as an SEA power source - directly from operating N&V (energy) level measurements. VSEA models are also an excellent way to conduct quantitative assessment of competitors' products.

- Better understanding of physics
- Answer N&V design questions

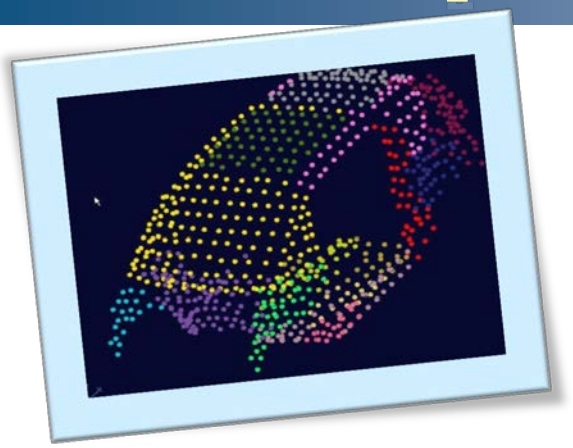
Exporting VSEA parameters

VSEA data are efficiently exported to universal file format usable in third-party software.

SEAVirt Specifications

Pre-requisite :

NASTRAN model and output files or NASTRAN software



FRF Virtual Data Generator

Several algorithms available:

Modal synthesis using FFT and numerical band integration

Modal synthesis using exact analytical integration of modal responses

All algorithms can be set as:

- User-defined frequency-dependent damping
- Selectable accuracy
- Band-integrated FRF frequency
- Band-optimized solution for faster computation
- Automatic detection of direction of maximum response

Automatic Subsystem Detector

Fast algorithms by attractive-iterative methods

- Group nodes together as subsystems
- 3D visualization of geometry and groups
- Manipulation of nodes by graphical selection
- FRF matrix visualized as Intensity graph

Multiple creation of subsystem sets

- Adapt the subsystem set to selected frequency band
- Multiple subsystem set creation and storage

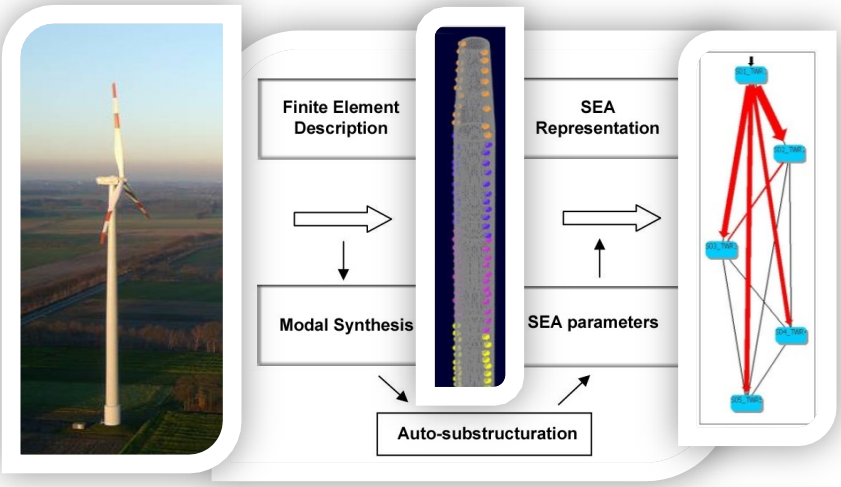
Virtual SEA Model Generator

Virtual SEA - Data Reduction

- Compress FRF data into square or rectangular spaced and frequency transfer velocity for a given subsystem set
- Provide real part of input mobility for all nodes

Virtual SEA - System Identification

- Easy SEA parameter identification and equation manipulation as simple 2D network
  - Graphical icons define subsystems
  - Coupling via network with 2D icon
  - Subsystem suppression, union, auto-renumbering and connect-all functions
  - Store/Open SEA model and results file
- Output variables: CLF, modal density, wave number
  - Modal density solver
  - Lalor 's simplified CLF method
  - Matrix estimation of CLF and Mass with random Monte-Carlo inverse or SVD pseudo-inversion methods
  - Mean and standard deviation
  - Auto-detection of connections between subsystems
  - SEA model optimizer for best- fitted solution



- SEA model solution and diagnostics
  - Apply multiple power inputs
  - Solve for subsystem energy, velocity or **S**ound **P**ressure **L**evel (**SPL**)
  - Subsystem power inputs, outputs
  - Network energy flow diagram
  - Model performance index for data reconstruction

- VSEA subsystem coupling with all SEA subsystems

Full Automation of the solve Process

- Automatic patch decomposition
- Create SEA models automatically scaled with frequency from patch

Managing VSEA models

VSEA model created with SEAVirt is used as standard SEA model to predict response to user-defined loads.

VSEA models can be customized. All VSEA subsystems can be coupled to analytical SEA+ subsystems to solve random vibration response to diffuse acoustic field or to predict transmission loss of VSEA subsystems.

SEAVirt models are also used to predict local responses at re-enforced points as it includes all local input mobility information at all its internal nodes.

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