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Technical Engineering & Research in Acoustics

SEA-XP version info

Summary

Presentation

SEA-XP software has been evolving continuously for the last past ten years to fit with the complexity of industrial design. This software is mainly an evolution of early routines developed from 91 by Dr. G. Borello to build SEA model of industrial engines. With the help of SEP (Société d'Etudes et de Propulsion) that has been designing the cryogenic rocket engine of Ariane 5, Vulcain, these routines have been turned progressively into a full operational software combining both acquisition and post-processing for a maximum of performance.
Starting from decomposition into subsystems of the system to be analyzed, SEA-XP is solving the active power balanced equations by measuring transfer acceleration and input power. More precisely the measured quantities are FRF's and input conductances as all accelerations are stored in FRF format and only the real part of the normalized input power/force² is used in the power equilibrium.
Here below, one of the first SEA-XP application where the experimental power balanced equations have been solved to built an hybrid SEA model of the Vulcain. The analytical formulations where provided by the Dr. Borello's SEA software EARTHS, specifically designed to model the Vulcain and completed and validated by import of experimental SEA parameters.

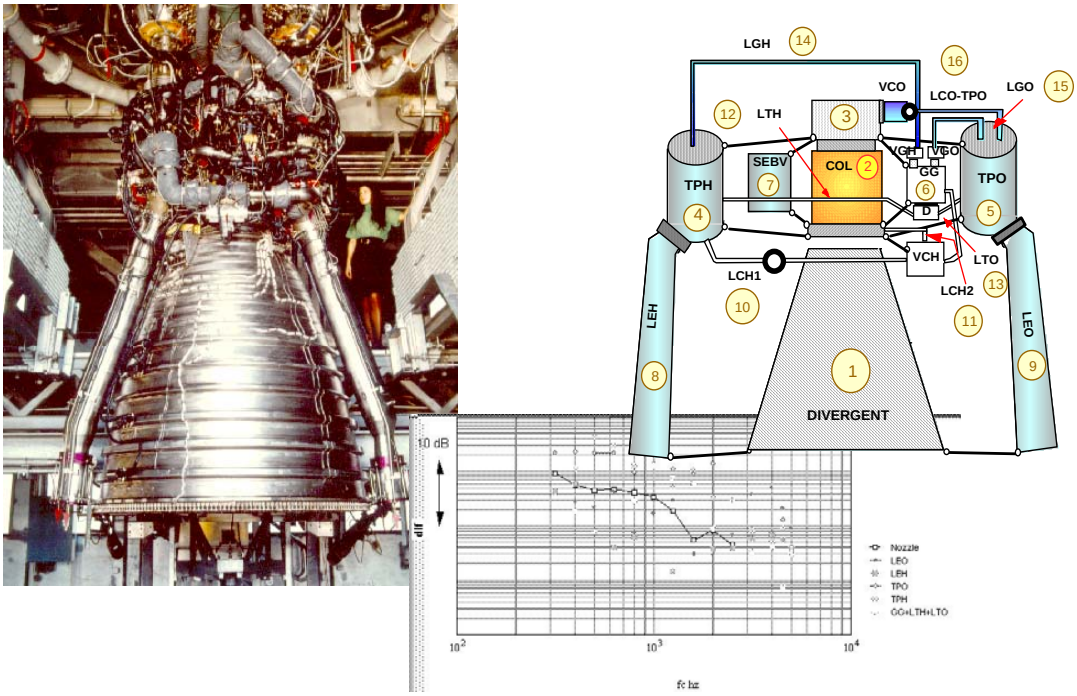

Figure 1 : The SEA Vulcain model built in 91 with the help of original SEA-XP routines and related

Why measuring DLF and CLF?

Separating internal and coupling losses

In most cases, the **damping loss factors** (**DLF**) of industrial structures cannot be computed theoretically. They are also depending on the assembly and thus cannot be determined from individual tests.

More of it, simple tests such as decay rate measurement cannot provide good enough estimates of subsystem DLF. In fact the DLF of a subsystem in a coupled model is related to the power loss that is intrinsically dissipated within this subsystem and which is not related directly to the decay rate of its impulse response. The decay rate is only proportional to the total loss related to a given subsystem i.e. sum of the intrinsic power loss within this subsystem and to the power dissipated in the coupling (that escapes to the other coupled subsystems). Thus the decay rate includes information about both intrinsic power loss and coupling loss.

The power losses into the coupling between subsystems are characterized by the related **coupling loss factors** (**CLF**).

The CLF level is depending upon the mechanical connection between subsystems.

To compute these coefficients in the high frequency domain, analytical SEA heavily relies on simplified hypothesis: ideal diffusion of energy, plane wave assumption, simple line or point connected junctions of homogeneous simple plates or shells. On real structures, junctions are far ahead in term of complexity.

Experimental SEA, by measuring all transfer velocities and input conductances from a set of simple impact or acoustic tests, is able to identify both intrinsic DLF and the CLF between any subsystems. The subsystems must exhibit local modal behavior in the frequency range of interest for the inverse problem identification to be successful and is de facto a “high frequency measurement” technique.

SEA model of complex industrial machines can thus be built with the help of this technology.

Using the SEA-XP estimates of CLF, it is possible to tune simple adequate theoretical models of junctions in order to perform parametric changes and noise reduction analysis. As shown here below, powerful SEA models of complex systems such as the French High Speed Train (HST) were built with accuracy using hybridization of analytical and experimental loss factors.

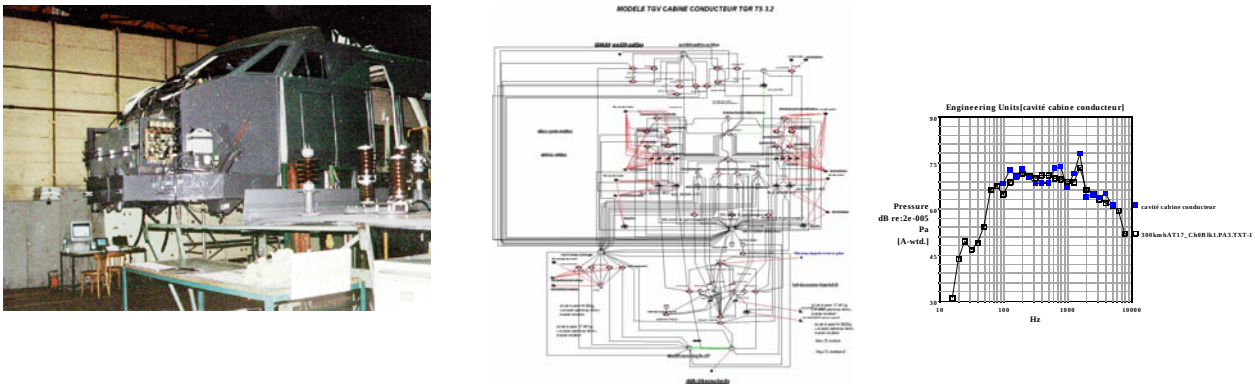

Figure 2: SEA model of the driver's cabin of French HST train for prediction of the airborne and structure-borne sound transmission (on the right prediction at 300 km/h and measurement in cabin

In cooperation with Alstom, the French train manufacturer, many train vehicles (cabin or coaches) have been modeled using experimental SEA leading to fine understanding of system behavior.

Analyzing subsystem polymorphism

Experimental SEA helps in understanding the polymorphism of subsystems (evolution of dynamical behaviour vs. frequency).
When applying experimental and analytical SEA to car modelling, it rapidly comes to an end that the frequency range of interest (100-2000 Hz) was very difficult to be successfully covered using only analytical description of subsystems.
Looking on the rear pillar shape of a car roof (Figure 3), it can be clearly seen that it is not easy to confine its SEA description in term of simple analytical beam or plate.
From experimental SEA, we learn about this subsystem by measuring both input conductance and CLF. It appears that this subsystem can be seen as a SEA beam at low frequency and as a SEA plate at higher frequency. The transition frequency domain just lies in the 800-1000 Hz.

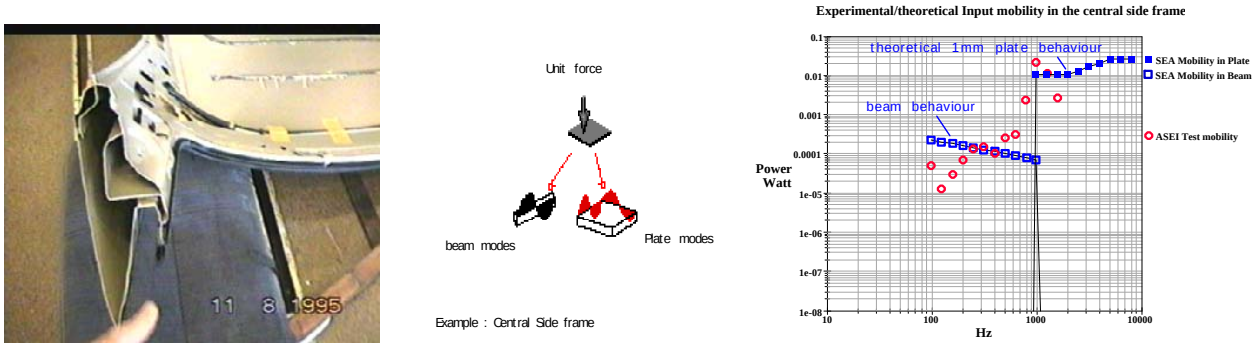

Figure 3: Analyzing subsystem polymorphism of car subsystem with experimental SEA

Most of the SEA subsystems of a car exhibit this dramatic change of dynamical behavior in this mid-frequency region, leading to difficulty in applying a “static” analytical description for each of them as required in commercial analytical SEA software.
Experimental SEA was thus used to find “equivalent” SEA analytical representation that could fit to the observed dynamical behavior.

SEA models for non-homogeneous structures

Experimental SEA is very useful to understand how non-homogeneous subsystems behave.
Non-homogeneous subsystems are characterized by some non constant parameters that can vary within the subsystem domain: non constant thickness, radius of curvature, material…
A car is typically made of many non-homogeneous subsystems.
Classical analytical SEA is ideal for homogeneous subsystems but how to derive an analytical representation of a shell with a non constant radius of curvature as an example?
Experimental SEA is using a multi-transducer approach to solve elegantly this problem.
In place of describing the subsystem by a single power balanced equation, referenced to a particular excitation (or to a particular transducer in reciprocal measurement), it uses as many power balanced equations as required with several reference excitation spread at various locations of the subsystem. Using more equations than unknowns in the solve process, it is possible to find a best-fitted experimental set of SEA parameters to characterized this non-homogeneous subsystem from the pseudo-inverse of the energy matrix (with a singular value decomposition or SVD solver).
Non-homogeneous subsystems are also characterized by high variability of velocity when scanning the subsystem domain. All estimates of measured energy and power are thus affected by some variance depending upon subsystem complexity.
When simply inverting the transferred energy matrix once, some SEA parameters can be negative on output and not really representative of the real statistical behavior of the

subsystem. A Monte-Carlo procedure has been introduced in the solve process to overcome SEA parameter dispersion:
-when recording the data, variance is computed for all inputs,
-when solving, the input data set is perturbed, following related variance of each of the input and the output set of SEA parameters is averaged with previous results obtained for another perturbation of the input data set
-the solve process can be run in loops several thousand of time in order to derive statistic and variance on output. Some solution sets that are obviously non physical can thus be rejected from the averaged solution (i.e. SEA sets that incorporates too many negative CLF of DLF values).
-the SEA loss matrix final solution can be characterized by a performance index, providing confidence in the result.

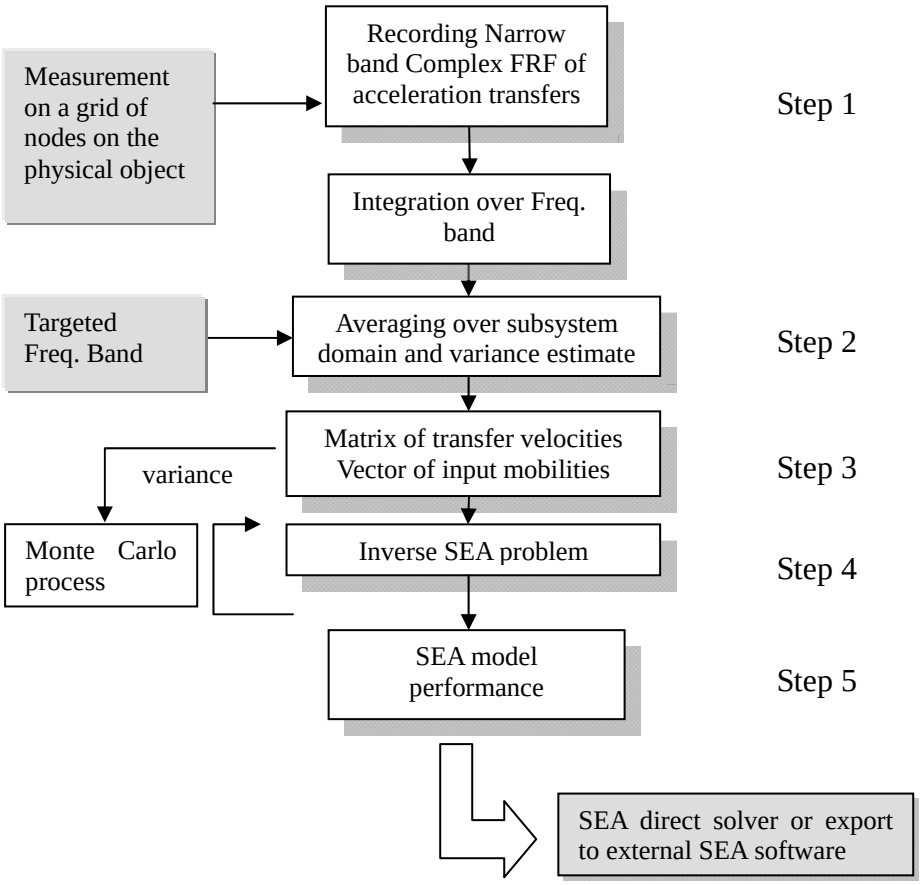

Figure 4: The data flow of experimental SEA

The velocity to energy conversion is performed through an “equivalent mass” term which is determined experimentally from the analysis of the decay rate of impulse responses of recorded FRF. This mass term is generally frequency-dependant as we deal with complex subsystems. The mass is nearly independent from frequency only for homogeneous simple systems. The use of equivalent mass in SEA is greatly improving dynamical behavior understanding and its computation does not require any additional measurement as it is fully automated in SEA-XP.

Acoustic and structural coupling

Most of the uncertainty in SEA models is contained in structural subsystems and SEA-XP was designed from the beginning to focus on structure borne sound transmission.
Nevertheless, a full acoustic-to-structure analysis has been included in the software in the mid-nineties.
Within SEA-XP, the only difference between acoustic SEA subsystems and structural subsystems is the type of recorded data. Generally, pressure measurement is used for acoustics and acceleration for structures. In SEA-XP, the data type for acoustics is a FRF computed as "pressure signal /reference signal". When computing the mean squared transfer velocity from the FRF, the software automatically converts all acoustic FRF into velocity spectra, using an impedance term (the acoustic impedance) that is defined for each record.
After averaging into squared velocity, there is no more difference between cavity and structures in the data set.
Various problems can be addressed by experimental SEA, from pure cavity coupling to full vibroacoustic analysis.

Example 1: Sound radiation of a car at 7.5 m and analysis of the sensitivity of absorption changes in the cavities below bonnet
The experimental SEA is used to determine optimal split of the acoustic space surrounding the engine, associated coupling apertures and intrinsic DLF values. The final model is a hybrid experimental-analytical SEA model able to reproduce within a few dB the noise radiated at 7.5 m outside the vehicle

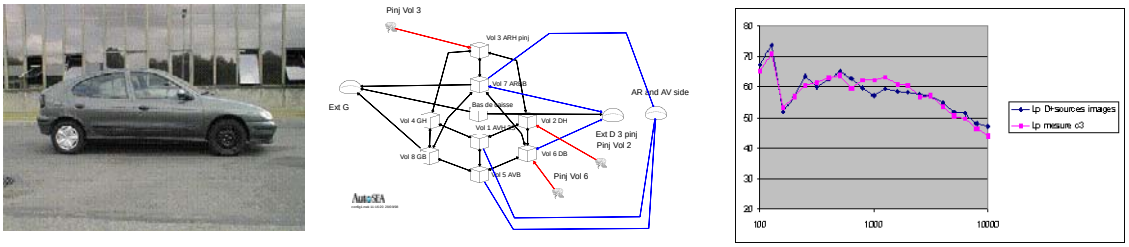

Figure 5: Prediction of sound radiation at 7.5m from the engine using hybrid SEA modeling and comparison of SEA predicted SPL (from engine radiated power) and measured SPL at 7.5 m

Example 2: Dashboard radiation
A full experimental model of a dashboard coupled with emitter and receiver cavities is created to analyze energy transmission paths between the two cavities and to predict the effects of changing trim configurations.

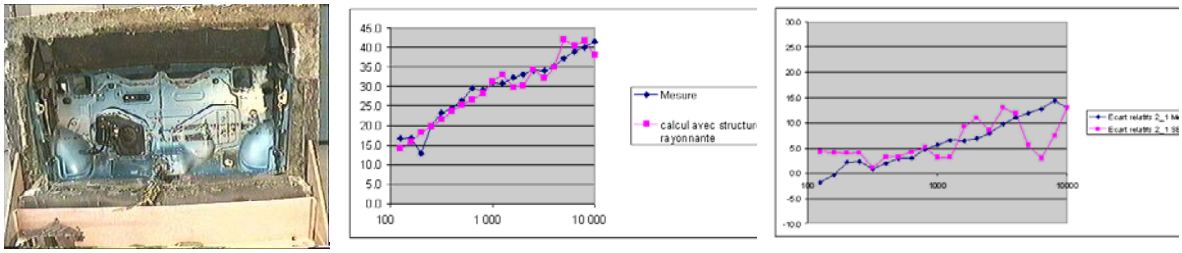

Figure 6: Prediction of dashboard transmission loss using experimental SEA model and comparison between relative change predicted from the model and direct measurement for two different configurations

Exporting experimental SEA model to analytical SEA software

Experimental SEA is a good complement of analytical SEA software. Analytical prediction can be validated for all parameters and experimental description can be substituted to analytical one when the subsystem complexity is not suitable with the simple analytical libraries.

AutoSEA1.5 was the first version of AutoSEA that was supporting import of experimental SEA data.

In fact from SEA-XP, you can export and open your experimental model to AutoSEA1.5 without any extra work using the neutral file format.

If an analytical AutoSEA1 model already exists, you can simply choose to write directly the experimental SEA information in the Neutral file of the analytical model. When subsystem names are identical in the experimental model and the analytical one, experimental SEA parameters of selected exported subsystems are allocated to the related SEA subsystems.

The first release of AutoSEA2 (2.0) was not compatible with experimental SEA. InterAC and VASCI (AutoSEA developers) have developed a common way of exchanging data between the software using the Universal file format (UFF). This was implemented in the AutoSEA2.1 version and available in the SEA-XP 2.1 version as well.

This functionality is currently the way to transfer data from SEA-XP to AutoSEA2 latest release.

The way it works is simple. In AutoSEA2, you can define alias names for each subsystem. The alias name of an AutoSEA2 subsystem should be the same than the related SEA-XP subsystem.

From SEA-XP you import all CLF, DLF information in a single UFF file.

From AutoSEA2, you first export this file in the database of the software then use the AutoSEA2 “tools” function to simply allocate the experimental coefficients to the right subsystems.

Recently, InterAC has released an optional extension pack to SEA-XP. This software pack includes AutoSEA2 scripts and additional function to directly import AutoSEA2 model within the SEA-XP environment. SEA-XP being experimental SEA software, the AutoSEA2 model is a parametric model of which coefficients are computed from the original model (using the scripts). If experimental SEA data are available for comparing with the AutoSEA2 model, the performance index of the analytical prediction can be quickly evaluated within SEA-XP environment and zone where the prediction is diverging easily identified. The AutoSEA2 model can also be compressed into fewer subsystems for easier sensitivity analysis using 2D-graphical visualization of power flows of SEA-XP.

Interface with SEA-TEST

SEA-XP .SEA binary files may now be imported in a SEA-TEST session. SEA-TEST is experimental SEA software developed for InterAC which acts as a post-processor of test data acquired with the B&K Pulse system. It is more automated than SEA-XP and works from the modal analysis test protocol available in Pulse. It also supports 3D geometry plot of measurement points location

For users who want to separate the acquisition from the post-processing, it the ideal product.

A descriptive brochure of SEA-TEST can be downloaded on www.interac.fr.

Review of software evolution

Version 1.0 (1996)

Macintosh version: used for train and air conditioner analysis

Version 1.2 (December 1997)

Supported OS: PC version under Windows 95 and NT4

Adding functionalities

Coherence :

In the module « E-SERIES 16CH », when you select « Press. FRF » or « Accet. FRF » and the average mode, you can select the button « Coher » to see the Coherence of your signal in real-time.

Modal Overlap

In the module « Experimental SEA », select Modal Overlap in the Graph menu to see the Modal Overlap of a sub-system.

NI-DAQ Driver

If you don't want to use « E-SERIES 16CH » and « Stream Acquisition » Modules, Now you can launch AutoSEA-X without installing NI-DAQ Driver on your PC.

Module Stream Acquisition

The new module « Stream Acquisition allows you to acquire continuous signal up to 16 channels in the meantime. It depends on your Hard Disk speed.

Module Signal Generation

A new module « Signal Generation » allows you to create some known signals in DAQ or Wave format.

Others

A lot of other small modifications were included in to improve the interface of AutoSEA-X.
Some small interface bugs were fixed.

Version 1.4 (1999)

PC hardware support

Adaptation of acquisition to bi-processor CPU

Improvement of project data management

Main Control Panel :

- Add function« Move » in menu « File » for moving a project file to another directory

- Visualization of user's directories of « Data SEA », « Data Standard », et « Post Processing » folder of the current test specimen

Acquisition system

- Setting of acoustic impedance for each of the channels where a MICRO transducer is allocated
- Improvement of the « bounce detection » algorithm
- Adding « Update Matrix » button in « SEA-X progress » to allow manual update of the FRF matrix for stored data (avoid too long initialization time in case of large SEA model)

- Option PCB 481A03: full support of RS232 of PCB signal conditioner

Post Processing :
« Auto Analysis » :
- Computation of the injected power : when DAQ files are missing, the injected powers are automatically computed from FRF to be stored as input conductance (real part of complex injected power normalized by force²). Physical mass of subsystem is thus required
- Automatic post-processing even in case of missing FRF. AutoSEA-X now create empty PI3 & DQ3 files for missing data and in targeted model, all related transfers are set to zero.
-Autosave of the model file at the end of the computation

« Average transfer velocity computation window »
AutoSEA-X now scans automatically related folders when changing the test specimenfor initialization the coupling matrix.

Version 2.0 (June 2000)

Acquisition : support for two acquisition boards up to 32 channels in both transient and stream acquisition modules.

Post-Processing: formula builder for easy post-processing (User's defined analysis).

Version 2.1 (July 2001)

The version 2.1 of SEA-XP includes additional features that enhance the software capabilities.
It is now fully compatible on export with AutoSEA2.1 import of user's defined data.
It is now possible to easily exchange data with AutoSEA2 and feed your analytical model with experimental SEA data in a friendly way.
The acquisition panel has been improved for more comfort and safety and some additional functions for post-processing and graphing have been added.
The experimental SEA routine is now able to work on incomplete data base (some transfer FRF are missing). That means you do not need to finish the experimental work to create the model. You can measure a few subsystems and then solve the related experimental model without any subsystem renumbering.
User defined analysis has been also improved with support for individual or multiple files one-third octave integration or average. Complex FFT formulas can be used now for going back and forth from frequency to time domain with your DAQ files.
It will also be found a powerful function for computing the third octave mode count from the phase of DAQ FRF. This function is intended to be used in order to check the mode count from equivalent mass which is sometimes biased when the modal overlap is low.
Acquisition Module update: trigger improvement (wait for trig)
Autofreeze of acquisition sequences
Different types of FRF or Autospectrum *averages* now available: functions H1 and H2

Graph: general preferences for all graphs

Plot improvement:

Water fall 1/3rd octave in acquisition
Export to Excel through ActiveX automation
dBA support
Nyquist plot
Export to Universal file format

Experimental SEA
-Management of incomplete data base (some data are missing but the model can be achieved)
-Adding functions “Find Null power subsystems”, “Find Under-threshold Power in Band Subsystems”, “Interpolate Power under threshold”
-Adding functions “SVD delete and SVD solve”
-Network customization (adding icons, comments and pictures to the network)
-AutoSEA2 compatibility for exporting experimental SEA parameters to AutoSEA2.1 software
-Importing data from experimental submodels

Revision 2.1

-*Stream acquisition:* the physical levels of stored files of extension .str (stream files) were not correctly computed if data were recorded with a card gain not equal to 1.
Now you can edit your str file and the level will be correctly plotted.

-*User's defined Analysis:* Complex FFT calculation was wrong for Inverse FFT due to incorrect calculation of block data size.
In order to make the Complex FFT safer, a new switch has been introduced in User's defined Analysis to explicitly perform complex FFT operations.

-Easier FRF post-processing: for Average velocity: in previous versions all DAQ FRF should have the same size and same sample frequency for a given excited subsystem.
In case it was not the case, unexpected errors could be generated when processing.
This has been fixed by removing the limitation of fixed sized FRF and sampling frequency.
Now size of FRF blocks and frequency can be changed during the acquisition at any time.

Version 2.12- Corrected bug:

-Average Velocity & Average velocity from AutoSpectra : fixes a bug when a FRF has a sampling frequency smaller then the FRF that are processed before.
Now sampling frequency can be changed at any time during acquisition.
-Graph: export for UNV autospectrum has been corrected as it was dependant whether or not the dB plot was enabled.
Now all data are exported to UNV in physical units independently of the Y-scale setting

Version 2.12-Improvement:

Power injected: For E-series user's only: a check box "phase correction" is now available when calling for power injected computation.
When enabling this correction, the phase due to multiplex recording is corrected. It is useful when force and acceleration are recorded on far away channel (example force on channel 0 and acceleration on channel 15).
The force must always be recorded on channel 0 for appropriate correction.

Windowing choice in Reverberation time computation T for better tuning of window truncation side effect.

Improvement in 2.14
Adding Function “Autocoupling scheme” in Experimental SEA

New options in the Solve menu: interpolate function for CLF and DLF
Source identification,: adding more options to the source identification

New options in the User's defined analysis:
-Adding 1/3rd octave computation from DAQ files
-Adding complex FFT computation

-New mode count function from DAQ FRF

Version 2.2 (May 2002)

-Windows XP support
-More readable General Setting panel with tab
-Full Support for E-Series, 4452 and 4472 NI board (PCMCIA or PCI bus)
-Support for on-board signal conditioner of the 4472
-Card is now selected for the AutoSEA-X main dash panel menu
-Adding tools for checking experimental SEA reconstruction (in menus of SEA-Experimental)
-New run-time engine (LabVIEW 6.1)
-New hasp driver (possible to get a USB dongle in place of Parallel port dongle)

-Experimental SEA: global model error reconstruction visualization

Bugs fixed from version 2.20 up to 2.24:
Acquisition:
-initialization problems of ICP controller for 4472 : solved in 2.24
-impossible to set Sample frequency on some board in General setting with Windows XP (related to NI driver bug: solved in 2.24 by clicking in “interchannel delay” in Setup daq card
-Some button of User's Defined Analysis are not working properly: solved in 2.25
-bad fonts initialization in some Windows configuration:
AutoSEA-XP.ini file has been modified in 2.25 to set fonts according to the .ini file definition

Improvement in 2.25: faster initialization in General Setting for all E-Series cards

Version 2.4 (February 2003) New name for the software: SEA-XP

Improvement in Experimental SEA:
-SEA model optimizer and model performance evaluation
-Full log file session with export to HTML TEXT or Word format
New project manager functions: FRF correction vs. DLF, a posteriori correction of data improved
General Setting improvement: full data base management for transducers

Version 2.40 up to 2.404

Acquisition module patches

-Some Bad sensitivity coefficients in General Setting after calibration: fixed
-Some windows are not initialized in Channel Viewer when restarting with a new number of channels: fixed
-Channel version number not correct: fixed
-Some crash in zoom window due to SEAF.dll errors: fixed
-Multi-card not effective: fixed

Post processing patches

-Debugging in latter versions as previous function leads to wrong Decay rate values: fixed
-Experimental SEA not computing DLF and CLF when negative value less than 100%: fixed
-Selection of SVD threshold not available: fixed

Some extra features have been added

-New item menu in the Project Manager for modifying DAQ time history:
-Change in the header of the signal is now possible
-Downsampling of DAQ with low pass filtering also possible
-DLF correction of FRF: you can modify the FRF by applying a correction as the squared root of the ratio of two DLF graphs you can import separately into TXT format

Computation improvement

The synthesized velocity or energy function has been rewritten for more performance. It has been vectorized and is only recomputed if some change occurs in CLF or DLF matrix (after solve for example)

Project improvement

-Export to MS word of graphs
The project selector has now extra option such as to relink with broken project paths and other minor improvements

Version 2.404 up to 2.409 (September 2003)

-Experimental SEA: Performance index was incorrectly calculated in some specific configuration: fixed
-PSD tools in Standard Analysis: the calibration coefficient was leading to incorrect PSD levels when different of 1: fixed
-Acquisition zoom graph 1/3rd octave calculation: a software crash sometimes occurs when opening a zoom graph when stating an acquisition session: fixed

Version 2.5 (January 2004)

-New run-time engine with faster graphing (LabVIEW 7)
-Tree view of project data
-Multiple file info in separate windows
-Storing and retrieving project from a single binary archive
-Unlimited number of graphs windows in project manager
-New UNV translator to import data from external data acquisition systems (B&K PULSE…)

Option (2004)

-SEA Sensitivity Analysis module (SSA) for fast correlations of experimental SEA model with AutoSEA2 models and transfer energy path analysis
(Come with AutoSEA2 scripts and additional functions in SEA-XP to sort energy paths from operating conditions and find the most sensitive parameters to change in the SEA network)

Version 2.6. (2006)

-From Version 2.6.4, correction of refresh problems that could occur in the project manager

- In the 2.6.3 it was needed to force the refresh of file listing by push the key "enter" to list files after post-processing
- This system event was not understood by SEA-XP. This is fixed in 264 and above

In 2.6.3 a dialog pane was not correctly centered (call in the optimization menu of experimental SEA subroutine)- problem fixed
-Reverberation time routine seems to be frozen: problem fixed
-Acquisition zoom 3D graph in demo mode: fixed

Version 2.7 (April 2007)

Experimental SEA menu All Simplified CLF:

-Dialog box progress sometimes locked: fixed
-Some CLF are not correctly allocated in the matrix: fixed
-Text property dialog box not properly closed, disabling closing of Experimental SEA routine: fixed

Experimental SEA menu Import from model

-Frequency shift was sometimes observed in the imported data: changed in management of index and frequency choice : problem fixed

Graph Export to UNV or to Excel

-First frequency of frequency spectrum was different from other leading to miscomputation of frequency step when exporting (fixed)

Auto-substructuration

-Cavities were not correctly detected in Autosubstructuration: fixed

- Reference Correlation matrix algorithm revisited now with two options : fast clusterization and genetic

Edit test specimen

-All subsystems parameters, surface, volume and mass, initialized to 1
-Adding edition of test specimen properties in the project manager

Experimental SEA multi-session opening

-Now you can open any number of SEA models at the same time in separate 2D-networks

Experimental SEA solver

-Improvement of Loss matrix optimizer: performance index now computed by same routine, adding local global performance index and extra menu
-Import from model: now loss factors from subsystems with same name can be averaged between imported and targeted models

-New subsystem edition pane (parallel editing)
-Possible manual import of 1/3 octave spectrum in any item of the experimental SEA model

Experimental power identification

-Adding function to Power identification routines: diagonalization of injected power, cleaning and interpolation of injected power in Monte-Carlo optimizer

Acquisition with DAQMx drivers

-Acquisition module now supports the DAQMx drivers. DAQMx drivers are behaving quite differently from traditional NIDAQ. The DAQMx acquisition and traditional NIDAQ acquisition are then two different item menus, corresponding to two different applications.
Setup DAQ card menu item is no more necessary with DAQMx, you simply need to configure in the NI Max application the different acquisition cards present in your system and driven by DAQMx
-The DAQMx acquisition module has been tested by InterAC with NI4472 physical hardware and with simulated hardware for others devices. It is then intended to work with all other NI cards supporting DAQMx.
When using several identical cards in a PXI chassis, you don't have to declare them as multiple cards device. You simply select the different slots and the different channels when starting the DAQMx acquisition module and they are seen as a single card device by the DAQMx driver. With 4472 (8 channels per card) you can select up to 4 cards as the display is presently limited to 32 channels maximum.

Display viewer

-The DAQMx viewer can be customized using the view manager in acquisition palette mx
-The DAQMx channel viewer is resizable

Level-meter display

-To quickly check dynamic range of the data, a new pane can be opened in DAQMx acquisition module: the level-meter display. From here you can check the dynamic range of all selected channels

Stream Task scheduler

-Now stream recording can be programmed as in VCR recorders

Version 2008.1 (April 2008)

Vista support

SEA-XP 2008 uses the LabVIEW 8.5.1 Run-time engine (compatible with VISTA)-faster and better memory management)

Experimental SEA Solver bug fixes and add-on

-Opening multiple sessions of models might involve memory confusion of private data of models (fixed by changing memory management of model data)
-Parallel editing might not correctly display subsystem setting: fixed
-Export to AutoSEA1 and 2 might not be correct for all data: fixed
-Adding extra check and options to AutoSEA1 export
-Adding options to the SEA Solver (use reciprocal CLF for null CLF)

Graphing data

-Graphs are now initialized with appropriate size
-Fixing ill-setting of parameters of “Export graph to word” (available in Graph menu)

GUI

-SEA-XP icon change
-Direct access to data acquisition setting files from Project Manager

Version 2009.1 (January 2009)

Vista 32 bits and 64 bits support

SEA-XP uses the LabVIEW 8.6 Run-time engine (compatible with VISTA32 and 64) and driver Daq-mx 8.9.
The 8.6 run-time has more capabilities than the previous one. During 2009, these new features will be progressively implemented in the SEA-XP GUI for improving user's comfort.

GUI

-Daq-mx acquisition viewer has been modified for better readability

Version 2009.2 (June 2009)

Update to LV runtime engine 8.6.1

Upgrading Daqmx support

Unlimited number of devices and channels may be selected for acquisition
Software trigger function automatically enabled for NI devices with no internal trigger
SEA-XP can now support all NI board suitable for acoustic & vibration

Version 2010.0 (June 2010)

Update to LV runtime engine 10

Support all 32bits Windows versions and all 64bits versions in native format
(supported OS: Windows XP, Vista and Windows seven)

Support for multi-core CPU and 64 bits NI drivers
More features available in Graphs

Version 2011.0 (December 2011)

Update to LV runtime engine 10-SP1

SEA-Experimental

In SEA-Experimental, mass calculation of SVD compacted subsystem has been modified. Mass is now equal to the sum of the mass of included subsystems. In previous version, mass was reference dependant. equal to the mass of each included subsystem,
Modification of Export format to VA One to for correct import of Power and mass

Bug correction of reference list when creating a SEA model in automated mode from SEA-XP manager. List was not initialized.

Card Driver
Support for multi-core CPU and 64 bits NI drivers