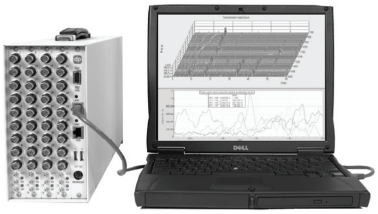
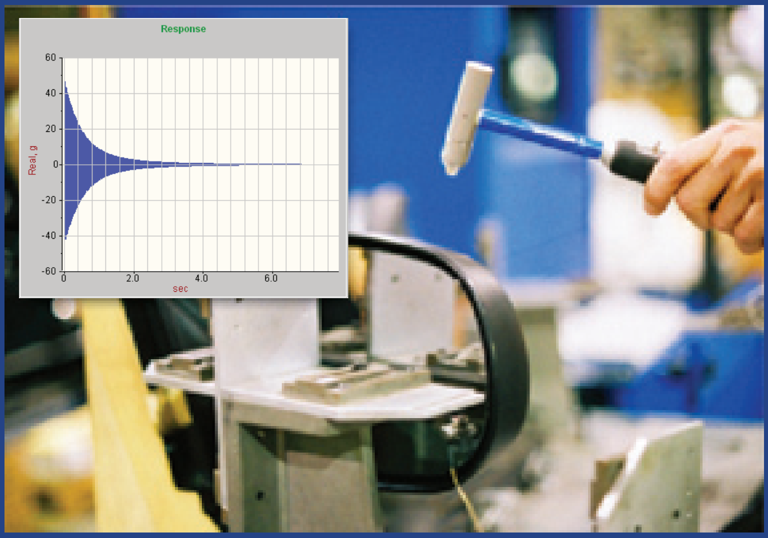
Powerful Software Applications

Structural Analysis

Engineered for SignalCalc Dynamic Analyzers

- ACE
- Mobilyzer
- Savant





Structural Analysis

SignalCalc analyzers are leading tools for modal analysis. They incorporate special signal processing features for impact and shaker studies, an automated bookkeeping scheme for the acquisition of FRF measurements and file export capability to automatically store measurements in the file formats expected by any of the popular modal analysis programs.

Mobilyzer and Savant analyzers, running on the Abacus hardware platform offer a minimum 120 dB dynamic range over the complete bandwidth available. In lower frequency applications, up to 150 dB dynamic range can be realized, making these analyzers the obvious choice for measurements where a high signal-to-noise ratio is imperative and for very high Q structures such as turbine blades.

Structural geometry information can easily be attached to measurements using Rectangular, Cylindrical or Spherical coordinate systems. The software also provides users with a programmable sequencer to automate the tagging of point and direction information in each successive measurement. This is particularly useful during impact testing as users will typically move around the system under test and "rove" the hammer impact at multiple locations and in different directions (e.g., x, y or z) while measuring the response of the structure at a fixed location.

Elegant data management utilities allow users to choose the results to be saved, such as frequency response functions, auto power spectra and cross power spectra, which may then be automatically saved at the completion of each measurement. Measurements can also be automatically exported to online modal analysis or animation programs in the native data formats of each.

Impact Testing

The SignalCalc transfer function analysis suite provides users with every conceivable utility to ensure accurate frequency response function measurements. Force and Exponential windows can be user defined, for the minimization of leakage.

SignalCalc analyzers provide a significantly improved implementation of the Force window designed to compensate for a known deficiency of the Response window. This "damping-compensated" Force window is of truncated exponential shape, rather than being a simple rectangle. The exponential shape used has the same time-constant (response Width) as the exponential applied to the Response window and automatically corrects the amplitude of the force spectrum to track variations in response spectrum amplitude caused by the time-of-capture position within the exponential Response window.

As a result of the manual nature of impact testing, maintaining consistency of measurements due to variations in the location and amount of the applied impact is difficult. SignalCalc analyzers provide a Preview Average mode that allows the user to examine the time and frequency domain views of each capture to verify impact data before averaging the new capture into the measurement.

Shaker Testing

SignalCalc analyzers offer a large range of excitation signals to cater to a variety of measurement situations. Random excitation of lightly-damped hi-Q structures results in response to excitation for a considerable period of time. The frequency response function, FRF, however, is computed from a series of finite-length observation "snapshots". Hence, the vibratory response during any given snapshot is the sum of response due to the excitation applied within that observation duration and the response due to prior excitation. Since the prior excitation is unknown when the snapshot is taken, its contribution represents measurement noise to which the coherence function is sensitive.

The solution to this problem is elegant in its simplicity. The duration of random noise applied is limited during each measurement interval so that the response can decay to zero during the observation. This assures that each observation contains only response due to excitation applied during the measurement; leakage is eliminated. This is accomplished in SignalCalc analyzers by using a ***Burst Random*** excitation, and by triggering the analysis on the source channel.

Multiple Input Multiple Output (MIMO)

The MIMO Analysis option permits analyzing Multiple-Input / Multiple Output (MIMO) processes and systems such as those encountered in advanced structural modal vibration studies. MIMO analysis measures the Transfer Functions of a system while it is stimulated by multiple shakers. Users can also measure transfer functions with different references even if a single shaker is available or when transmissibility measurements are carried out.

The SignalCalc MIMO option is both time-efficient and precise. Using multiple shakers to excite different structural locations and directions simultaneously provides the highest quality measurement of structural properties for several reasons. Firstly, because the inputs are distributed, a higher level of excitation energy may be imparted without overstressing the test specimen; this provides more detectable responses. Secondly, the distribution of excitation assures that all modes in the studied bandwidth will be captured. Thirdly, the boundary conditions remain consistent during the characterization of all modes. Single-point methods often require a sequence of tests using different shaker drive-sites to complete the structural characterization; each of these imposes different constraints. Excitations available from the different source channels in SignalCalc analyzers are also uncorrelated with each other, ensuring the correct computation of transfer functions for each combination of reference and response channel.

The computationally intensive nature of MIMO testing is efficiently handled behind the scenes and users can still employ the superbly intuitive and flexible SignalCalc user interface to make multiple transfer and coherence function measurements which are clearly laid out in the Signal Map.

Stepped Sine

Stepped sine transfer function option in Mobilyzer and Savant analyzers provides sinusoidal excitation for measurement of systems that cannot be excited by broad band signals such as closed loop systems. A sine output can be stepped over a broad frequency range following constant magnitude or a profile of varied magnitude versus frequency. Coherence limiting speeds the measurement by stepping to the next frequency when the desired coherence value has been reached.

SignalCalc Stepped Sine measurements can be broken up into a series of bands so that users may select finer resolution in areas of particular interest, boost the source level where the system response if known to be low or simply more slowly near resonances.

Users may treat the stepped sine measurements as a series of averaged measurements using an FFT and a tracking filter, or as a series of more swept-sine like measurements using a long integration time and only evaluating a DFT at the current frequency. The process can be expedited using a variety of simple checks provided by the system. For example, the user may specify a maximum number of iterations permitted before the system continues on to a new point. The software also offers estimation of the open loop transfer function using a three-channel technique, which improves precision.

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