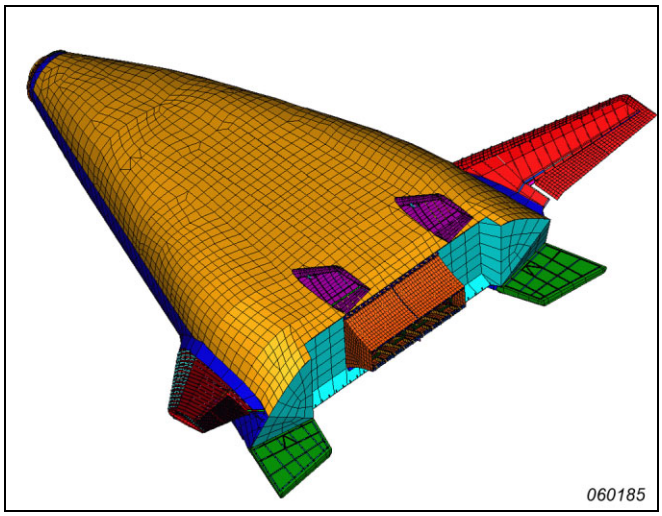
PRODUCT DATA

Test for I-deas Sine Processing Software Modules: Sine Processing — BZ-6010, Closed Loop Control — BZ-6011, Multi-Sine Processing — BZ-6012, and Normal Mode Tuning — BZ-6013

Test for I-deas sine processing software modules measures the response of a structure due to sine excitation to create spectra, auto-spectra, spectral matrices, or FRFs. The measurements can be for single or multiple reference measurements depending on the software module you have acquired.

Test for I-deas software offers the following methods to address a wide range of sine measurement requirements:

- *Step sine*
- *Sine reduction*
- *Step sine closed loop control (with BZ-6011)*
- *Multi-sine processing (with BZ-6012)*
- *Normal mode tuning (with BZ-6013)*



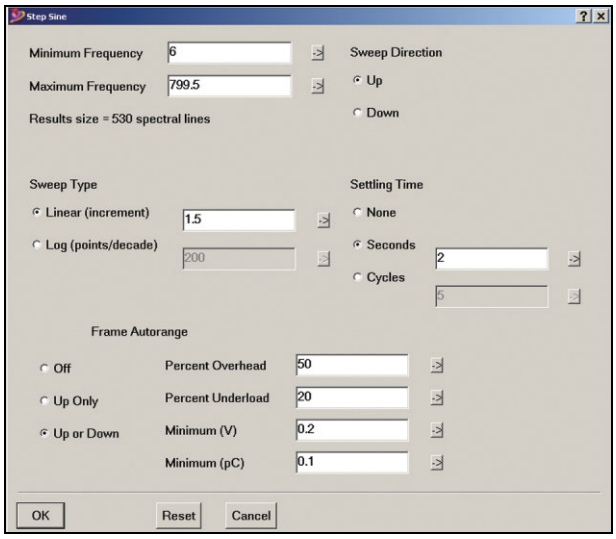
Test for I-deas Sine Processing Software

Measuring Response to Sine Excitation

If a structure is linear, then any form of excitation will give exactly the same results during a modal test. Generally speaking, random excitation has become the preferred method for testing a real-world structure. The main reason for this is that random force inputs tend to “linearise” any inherent nonlinear behaviour in the structure, resulting in data that is more useful in correlating a linear finite element model. However, where it is necessary to characterise a structure’s nonlinearities in great detail, or when existing operating forces or the size of the structure requires artificial excitation energy be concentrated, sine testing may be used.

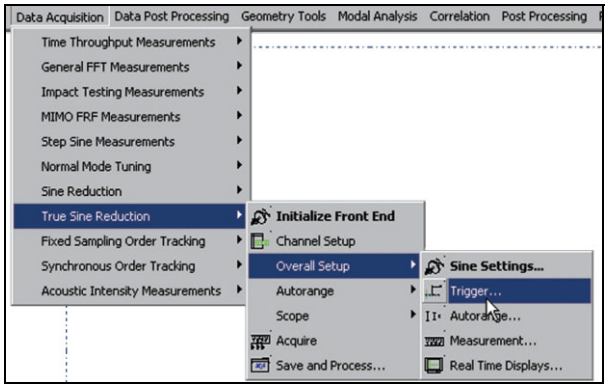
Sine Processing – BZ-6010

Step Sine



The Step Sine method controls the source sine output directly from within Test for I-deas software during an acquisition by stepping through a range of frequencies selected by the user. Options include the frequency range, direction, and a linear or log increment. The user can also set a frame auto-range option and a settling time to wait before acquiring data at each frequency step. A measurement is taken after the indicated setting time and the spectral line closest to the current source sine frequency is moved into the results and the software moves to the next frequency, where the process is repeated. The phase measured on the response channels is adjusted relative to the phase of the reference channel. A flat top window is applied during the measurement to provide accurate amplitude estimates.

Sine Reduction



The Sine Reduction method measures sine data while an external source is controlling the sine frequency (such as during a sine sweep). The reference channel is used to determine the frequency of the sinusoidal response. The spectral line closest to this frequency is moved into the results. The phase measured on the response channels is adjusted relative to the phase of the reference channel. A flat-top window is applied during the measurement to provide accurate amplitude estimates. The results are sorted by frequency. During the measurement, duplicate frequencies in consecutive frames are ignored. The results are sorted by frequency after the measurement is completed.

Closed Loop Control – BZ-6011

Step Sine Closed Loop Control

Closed Loop Control adds the ability to control amplitude levels or phase relationships to the Step Sine method. For each source channel, the user can define a target amplitude and/or phase for a particular measurement channel. The software will adjust the source output to obtain the desired response for that measurement channel. At each frequency or step of the measurement, the software goes into a control algorithm that continually adjusts the source output until it attains the target amplitude level and/or phase within a specified tolerance. Once control is achieved, the spectral line closest to the current source frequency is moved in to the results, and the software moves to the next frequency, where the process is repeated.

Multi-Sine Processing – BZ-6012

In the standard Test for I-deas single-input swept sine procedure, a single reference is assumed. The Test for I-deas software assumes that channel one is the reference, computes FRFs, and the linear spectrum results are not available.

Test for I-deas Multi-Sine enables additional capabilities not found in Test for I-deas Stationary Processing module to accomodate multiple channel measurements:

- In the Step Sine Measurement Setup form, the user can specify that the results of a sine sweep be stored as a (linear) spectrum for each measurement channel
- Using the programme MPSINE, the results of several sweeps can be used to calculate FRFs that, barring significant nonlinearities, will exactly match the results from multi-input random

Normal Mode Tuning – BZ-6013

Normal Mode Tuning is used to perform classic normal mode sine testing with multiple shakers. Functionality is available to "tune" the mode by visual reference to lissajous figures and/or peak amplitudes. Data capture includes mode shapes, as well as steady state and transient waveforms. The Normal Mode Tuning method consists of three parts:

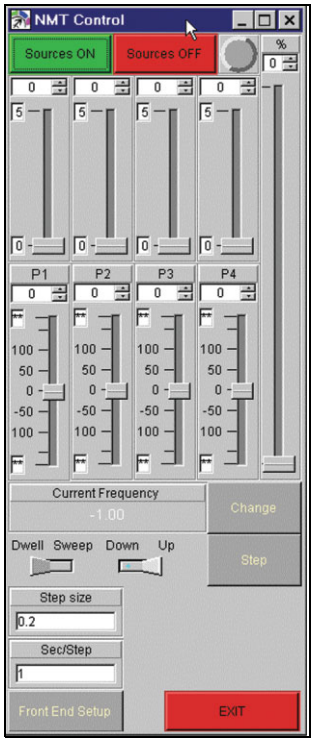


Fig. 1
The Normal Mode Tuning Control component

- **Control Component –** Performs data acquisition and control, and sets up shared memory accessed by the Display and Phase Scatter Display components (see below). The control component runs continuously, updating shared memory in the host with new data, unless the capture function in the Display component is activated. In those cases, data collection stops at the end of the current block, following which the trigger function is armed. Upon exiting the Capture panel, continuous data collection is resumed
- **Display Component**: – contains four displays:
  – A filtered "all channels" Magnitude display. A bar appears indicating the magnitude at the current frequency, in volts or engineering units. The cursor reads out the channel number and the magnitude
  – A filtered Lissajous display. Shows the Y1–Y4 channels (vertical) versus the selected X-channel
  – An unfiltered Waveform display. The channels displayed correspond to the settings in Y1–Y4 fields
  – A Magnitude Sum display. The sum of the response channels
- **Phase Scatter Display Component** – For each active channel in a data acquisition session, a marker at the x, y head of the vector magnitude, represents the peak amplitude at the selected frequency of the channel and phase relative to the reference channel. The magnitude and phase values are computed by FFT and power-in-band calculation around the reference frequency, as opposed to locating zero crossings in the time domain, due to the likely presence of harmonics in the signal

Specifications – Test for I-deas Sine Processing Software Modules

PREREQUISITES
Test for I-deas Core Test BZ-6000
Test for I-deas Stationary Processing BZ-6005

Test for I-deas Sine Processing – BZ-6010

STEP SINE MEASUREMENT METHOD
Selectable frequencies:
- Frequency range
- Direction
- Linear or log increments
- Setting of frame auto-range
- Setting of wait time before acquiring data at each frequency step

Window: Flat top
Phase: Measured on the response channel relative to reference channel

SINE REDUCTION MEASUREMENT METHOD
Measures sine data while an external source is controlling the sine frequency. The reference channel is used to determine the frequency of the sinusoidal response

RESULTS
- Harmonic distortion
- Results vs time or vs reference frequency
- SIMO FRFs
- MIMO FRFs (requires Multisine)
- Mode shape capture
- Sine decay capture

Test for I-deas Closed Loop Control – BZ-6011

Same as with Sine Processing BZ-6011, plus:
If a target amplitude and/or phase is defined, the software continually adjusts the source output until it attains the target amplitude level and/or phase within a specified tolerance at each frequency or step

Test for I-deas Multi-Sine Processing – BZ-6012

Same as with Sine Processing BZ-6011, plus:
Enables additional capabilities not found in Test for I-deas Stationary Processing module:
- Results of a sine sweep can be stored as a (linear) spectrum for each measurement channel
- MPSINE programme allows the results of several sweeps to be used to calculate FRFs that, barring significant nonlinearities, will exactly match the results from multi-input random

Test for I-deas Normal Mode Tuning – BZ-6013

Same as with Sine Processing BZ-6011, plus:
Classic sine testing with multiple shakers. Tune the mode by visual reference to lissajous figures and/or peak amplitudes
Data Capture: Mode shapes, steady state and transient waveforms
Control Component: The Control component runs continuously, updating shared memory in the host with new data
Display Component: Four displays:
- Magnitude display – a filtered all-channels display with a bar indicating the magnitude at the current frequency, in volts or engineering units. The cursor reads out the channel number and the magnitude
- Lissajous display – a filtered display that shows the y1 – y4 channels (vertical) versus the selected x-channel
- Waveform display – an unfiltered display in which the channels correspond to the settings in the y1 – y4 fields
- Magnitude Sum display – shows the sum of the response channels

Phase Scatter Display Component: A marker at the x, y head of the vector magnitude represents the peak amplitude at the selected frequency of the channel and phase relative to the reference channel. The magnitude and phase values are computed by FFT and power-in-band calculation around the reference frequency

Ordering Information

BZ-6010-F	Test for I-deas Sine Processing
BZ-6011-F	Test for I-deas Closed Loop Control
BZ-6012-F	Test for I-deas Multi-Sine Processing
BZ-6013-F	Test for I-deas Normal Mode Tuning

SERVICES

M 1-6010-F	Annual Software Maintenance and Support Agreement
M 1-6011-F	Annual Software Maintenance and Support Agreement
M 1-6012-F	Annual Software Maintenance and Support Agreement
M 1-6013-F	Annual Software Maintenance and Support Agreement
M 2-6010-F	Annual Software Maintenance and Support Agreement
M 2-6011-F	Annual Software Maintenance and Support Agreement
M 2-6012-F	Annual Software Maintenance and Support Agreement
M 2-6013-F	Annual Software Maintenance and Support Agreement

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