Overview

The JAGUAR supports a broad range of applications for multiple exciter testing. These MIMO (Multiple Input – Multiple Output) applications include:

- **MIMO Random** 2580-9420
- **MIMO Swept Sine** 2580-9421
- **MIMO Waveform Replication** 2580-9423
- **MIMO Shock (Transient Waveform Control)** 2580-9424

These control applications are capable of running with up to 12 or 16 DACs and 76-98 measurement channels simultaneously for real time adaptive control, phase control and cross coupling compensation. Separate technical specifications (data sheets) are available for each of these control applications.

Advanced Features

The standard MIMO applications may be extended to support state-of-the-art options including:

- **MIMO Random Advanced Features** (2580-9430): Supports Rectangular and Hybrid control algorithms and I/O Matrix Transformations. The standard MIMO Random option (2580-9420) is a prerequisite.
- **MIMO Swept Sine Advanced Features** (2580-9431): Supports Rectangular and Hybrid control algorithms, I/O Matrix Transformations and Multiple Variable Control. The standard MIMO Swept Sine option (2580-9421) is a prerequisite.
- **MIMO Waveform Replication Advanced Features** (2580-9433): Supports I/O Matrix Transformations (standard and rotational) and Multiple Variable Control. The standard MIMO Waveform Replication option (2580-9423) is a prerequisite.
- **MIMO Shock Advanced Features** (2580-9434): Supports I/O Matrix Transformations and Multiple Variable Control. The standard MIMO Shock option (2580-9424) is a prerequisite.

Each of the advanced features is described below. These features are currently being used in several world-class testing facilities. The same general description applies to all supported applications, unless noted otherwise.

Rectangular Control

You may change the control scheme for the control loop among Square control, Rectangular control and Hybrid control with null drives. The standard applications support Square matrix control algorithms where the number of Control points are equal to the number of Drive points. The Rectangular control algorithms allow more Control (Reference) points than Drive points and produce a form of average control. Any unused Drive hardware channels may be ignored by using the 'Number of Drives' parameter.

Hybrid Control

Hybrid control is used with I/O Transformations to force particular Drives to zero energy (Null Drive) below a selected frequency. These Drives are then transformed into the drive outputs which drive the actuators. This essentially supports a transition between the Square and Rectangular control methods. In the setup, you may define an equal number of drive channels and control channels. Below the Transition Range, there will be no energy for the null drives. Above the range, 100% of the drive signal is active and standard Square control is used. Below the range, there is no drive energy for the null drives; therefore Rectangular control is used. In the Transition Range, the drive energy is linearly transitioned from 0% to 100%. When the number of Null Drives is zero, the Transition Range values are forced to the minimum frequency, indicating that all of the drive energy is applied to the full test bandwidth.

I/O Matrix Transformations

The I/O Transformations essentially support conversions between different coordinate systems. The graphical user interface allows you to enable or disable the input and output transformations. The input transformations change input signal vectors into Control vectors. The output transformations change a Drive vector into a vector of drive signals suitable for driving multiple actuators. You must enter the number of transformed Controls. This value is also the size of the reference matrix. You must also enter the number of output hardware channels (Drive Outputs) used in the test. The Input Transformation Matrix is a complex matrix of size N_c x M_c and contains the conversion values. N_c is the Number of Controls selected above and also determines the size of the reference tables. M_c is the Number of Control Inputs as determined from the Channel Table selection "Control/Inp". These inputs are the transducer signals. The Output Transformation Matrix is a complex matrix of size N_d x M_d and contains the conversion values. N_d is the Number of Drives and is the same as N_c, the Number of Controls (assumed Square control). M_d is the Number of Drive Outputs (output hard-ware channels connected to actuators). Panels are available to edit the Input Transformation Matrix and the Output Transformation Matrix. You may enter complex values (real and imaginary parts) for the matrix conversion values. MIMO Waveform Replication also supports a rotational compensation process called Time Dependent transformations; the standard method is referred to as Time Independent.

Multiple Variable Control

Some environments are difficult to control when using traditional accelerometers for control of low frequencies. This may be overcome by using multiple control variables, such as acceleration and displacement. For this case, acceleration and displacement transducers are co-located at the desired control points. During system identification, the Frequency Response Matrices are computed for both types of transducers (from acquired data). Both matrices are inverted to produce the displacement impedance matrix and the acceleration impedance matrix. The MIMO application computes an equivalent displacement reference based on the acceleration reference that you entered. You may also enter the desired Transition Range where the control variable changes from Displacement (for low frequencies) to Acceleration (for higher frequencies). A pseudo-velocity control variable is used in the transition range.

SPECTRAL DYNAMICS

Spectral Dynamics Inc.
2730 Orchard Parkway
San Jose, CA 95134-2012
Tel 408 678-3500
Fax 408 678-3580

www.SpectralDynamics.com