

# **Multi Axes Shaking Table**

# **Noise and Vibration**

Squeaks and rattles are a predominant indicator of subjective vehicle quality. The MAST is particularly well suited to investigate such noises. Caused by components either rubbing together or resonating, these noises are generally non-linear in nature, occurring at discrete frequencies or amplitudes. The ability of the MAST to reproduce the excitation causing these noises makes it invaluable in their isolation.

# **Ride Quality**

Subjective evaluation of ride quality was the first application of the MAST and remains one of its predominant testing applications. KNR has a specific MAST model designed to assist the study of human evaluation of ride quality. This particular design is carefully crafted to ensure test subject safety while providing the evaluation engineer a fully capable test system.







Fig. 1 Multi Axes Shaking Table System Overview

A seismic simulation testing system can be used to test the response of structures to verify their seismic performance, one of which is the use of an earthquake shaking table.

This system is for shaking structural models or building components with a wide range of simulated ground motions, including reproductions of recorded earthquakes time-histories. While modern tables typically consist of a rectangular platform that is driven in up to six degrees of freedom (6DOF) by servo-hydraulic.

# Table. 1 Multi Axes Shaking Table System Specifications

Technical Parameters					
Table Size	1800 X 1800 mm				
Max. specimen mass	3,000 kg				
max. accel. with specimen (Z/X/Y)	0.8 / 1.5 / 1.5 g (@2Hz)				
Peak vel. with specimen (Z/X/Y)	0.6 / 1.1 / 1.1 m/s				
Stroke (Z/X/Y)	250 / 250 / 250 mm				
max. angle Pitch/roll/yaw	8/8/8°				
Specimen max. center of gravity above table	2000 mm				
max. overturning moment	300 kN.m				
HPU Nominal flow	300 lpm				
HPU Operating pressure	21 MPa				



# 6 DOF Seismic Simulation Syster

There are four modules for the six DOF seismic simulation control system. First module is the Deneb-DE which is connected to sensors and actuators for the real time controlling. Second module is the Sabio-D to transmit the user's command to the Deneb-DE and show the status of actuators' real time information. The rest modules are Sabio-K and Sabio-M (Pre and Post processing module) to calculate and converse the data from the actuators and sensors.



Deneb-DE transmits operating signals of the actuators, service manifold, and etc. and sensor signals of the LVDT, load cell, accelerometer, and etc. to the user.

Sabio-K which is to control the system and produce the test result makes a six DOF operation file through the process of calculating the kinematics of earthquake wave file. In addition, it has an edit function of the six DOF operation file.







# Sabio-K

The Sabio-K has the pre-processing function to make a signal for controlling the system from the earthquake data or random data.

Function	Specification					
Inverse kinematic	6DOF data					
	to 8 axes data conversion					
	Earthquake File load (*.at2)					
	Sine, Cosine, Triangle, Square					
Signal generation	Trapezoid, Point to Point					
	Sweep, Random square					
	Random					
Signal edit	Digital filter (LPF, BPF)					
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#### Sabio-M

The Sabio-M is a post processing software to provide the various data about the test result after the calculation of the forward kinematics from controlling result of the Deneb-DE and Sabio-C by real time.

Function	Specification				
Forward kinematic	8 axes data				
	to 6DOF data conversion				
Data display	6DOF displacement				
	6DOF acceleration				
	8Ax displacement				
Data acquisition	6DOF displacement				
	6DOF acceleration				
	8Ax displacement				

Adaptive harmonic cancellation



# Sabio-K & Sabio-M

# Sabio-D

The Sabio-D distribute the analyzed 8 axes operation data by the inverse kinematic to the each actuator and has functions of compensation and monitoring.

Function	Specification				
Cabadular	8 axes data load				
Scheduler	repeat, hold, event				
Compensator	Amplitude phase compensator				
	Force balance compensator				
	Overturning moment compensator				
	Off center load compensator				
Set point	Auto initial point moving				

Function	Specification
8 axes control	
Three variable control	Displacement, Velocity, Acceleration
On - line iteration	
Limit detect	
HSM, Parking system control	

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### Sabio-C

The Sabio-C is to control the actuators with transmitted reference command from the Sabio-D. The Sabio-C is an interface between the hardware and Sabio-D. Therefore, the user doesn't need to operate anything.

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