

Multi-Axis Testing Webinar – May 2013

Todays Presenter: Mark J Chomiczewski

We will begin shortly!





Multi-Axis testing



So what is Multi-Axis testing?

• Most testing is single axis





So what is Multi-Axis testing?

• When UP isn't Important....single shaker axis may be enough







- More "Real World" simulation in the lab
- Shortened Test Time
 - Typical 30 hr per axis single axis test = 90 hrs
 - Simultaneous 3-axis = 30 hrs



Our Multi-Axis Control Solutions

- Dual Axis with Phase control
- 3-Axis (x,y,z)
- Multi-Loop (2,3 or 4 loops)
- Multi-Axis Tripod

* No 6 DOF at this time



Multi-Axis Control Solutions

• We start with hardware - VR9500





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Multi-Axis Control Solutions



Dual Axis



3-axis (x,y,z)



4-post/multi-loop









Multi-Axis Drive & COLA











- Uses both output drives of a single controller
 - Drive & COLA
- Test profiles are same for both drive outputs
- Sine
 - Adjustable phase angle between the two outputs, +/-180 degrees.
- Random
 - Auto controls to 0 deg phase difference between loops
- Shock
 - Auto controls to 0 deg phase difference between loops



More about Phase Control



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Side view of shakers



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Dual Axis setup







3-Axis (x,y,z)





3-Axis Testing

- Typical Multi-Axis Applications
 - Random
 - Field Data Replication Time History
 - Earthquake/Pyro-Shock (SRS & Time Waveform)





3-Axis Testing

- Uses output drive of 3 controllers, one for each axis
- Test profiles can be different for each axis (but same test type)
- Random
 - Same or different test profiles
- Field Data Replication
 - Time history playback. Same or different profiles





- MIL-STD-810G, Method 527
 - Multi Exciter Testing/Multiple Axis (MEMA)
 - Time History
 - Random
 - Recorder
- Automotive
 - Random with Kurtosion®
 - Time History



3-Axis Testing







3-Axis settings

Parameters Directories	Hardware	Users	Verification	Graph Defaults	•	Each Loop can be
Inputs Outputs Units	Limits Tripod	Remote Inputs	E-Mail Notification	Web Server		given a new name to
Drive Output						help identification
Range +/-10 Volts						
First drive check 20 💌 %						
Second drive check 50 🗸 %						
- Aux Output						
COLA/Aux: Disabled	-					
	/					
-Loop Labels						
1: X Axis 2: Y axis	3: Z axis	7				
			1			



3-Axis Random – Enable Loops



3-Axis FDR



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Multi-Loop Options



Multi-Loop Options









- 2, 3 or 4 drive loops
- Usually all in a single Z axis (4 post)
- One drive loop per controller
- Same profile or different profile per loop
- Random, Shock, FDR (time history)

* Phase of output drive files is synchronized between outputs for Shock and FDR.



Multi-Loop Setup







Multi-Loop Labels



Multi-Loop – Enable Loops





Multi-Loop – Set test profile



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Select and set up a test profile for each loop



Multi-Axis Tripod



Multi-AxisTripod





Multi-Axis Tripod







- IEEE-344 earthquake tests
- The tripod hydraulic shakers are set up to constrain pitch, roll yaw, and only allow X,Y,Z motion
- Transient software plus IEEE test software
- 3 controllers plus geobox
- Sine, random and FDR One controller can be used to drive X,Y, or Z axis alone.











Video Links

- Dual Axis with Phase Control
 - <u>http://www.youtube.com/watch?v=w3AiVtITrUo</u>
- 3-Axis (x,y,z) Control
 - <u>http://www.youtube.com/watch?v=uLYrLt47OLE</u>
 - <u>http://www.youtube.com/watch?v=p1m5Eb1w8ss</u>
- Multi-Loop Control
 - <u>http://www.youtube.com/watch?v=EaMsSvSthLA</u>
- Multi-Axis Tripod Control
 - <u>http://www.youtube.com/watch?v=sC2Kr19WemE</u>





Thank you!

