

APPLICATION EXAMPLES USING EDM MODAL Year 2021

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by Aakash Umesh Mange – Application Engineer www.crystalinstruments.com | info@go-ci.com



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Year 2021: Application Examples Using EDM Modal

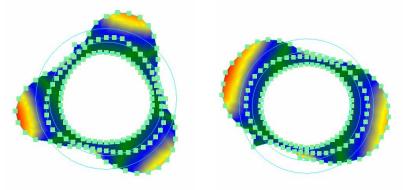
Illustrated below are some customer applications in varying industries who are using the hardware and software by Crystal Instruments to analyze and understand the structural properties of their test specimen(s). Analyzing the modal characteristics namely natural frequencies, damping and mode shapes of the test unit further helps in improving the design to enhance the mechanical behavior of the test unit.



Modal Analysis of Pole Generator

This customer in UK executes modal analysis using CoCo80X and EDM Modal to ensure that the natural frequencies are not close to the forcing frequencies of their pole turbo generator.





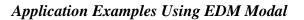


Ground Vibration Test

A customer is using Spider-80M and EDM Modal for their ground vibration test which is not only used to validate analytical models but also used to predict the flutter of the aircraft in order to create a safe flight envelope before the flight operates.





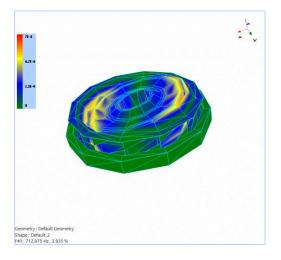


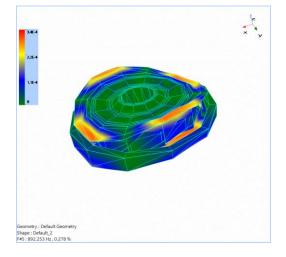


Modal Analysis of Train Wheel

This overseas customer is executing modal analysis using Spider 80Xi and EDM Modal to understand the dynamics of wheel-rail interactions. During the ride or brake operation of a train, there could be certain excitation frequencies which could cause the resonance phenomenon and potentially affect the safety and comfort of passengers.





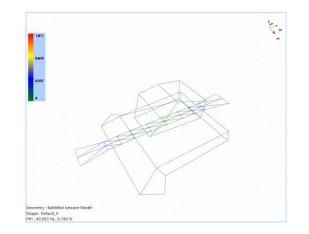


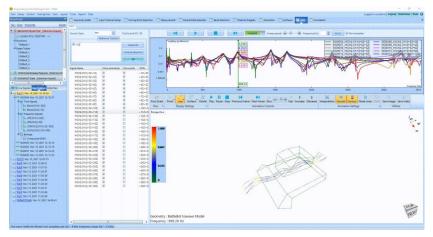


Modal Analysis of Robot

This customer participates in robot combat competitions called BattleBots and is using Spider80X and EDM Modal to understand the structural properties of the blades. This modal survey helps in optimizing the design of the robot for improving the mechanical behavior during each of the battles.



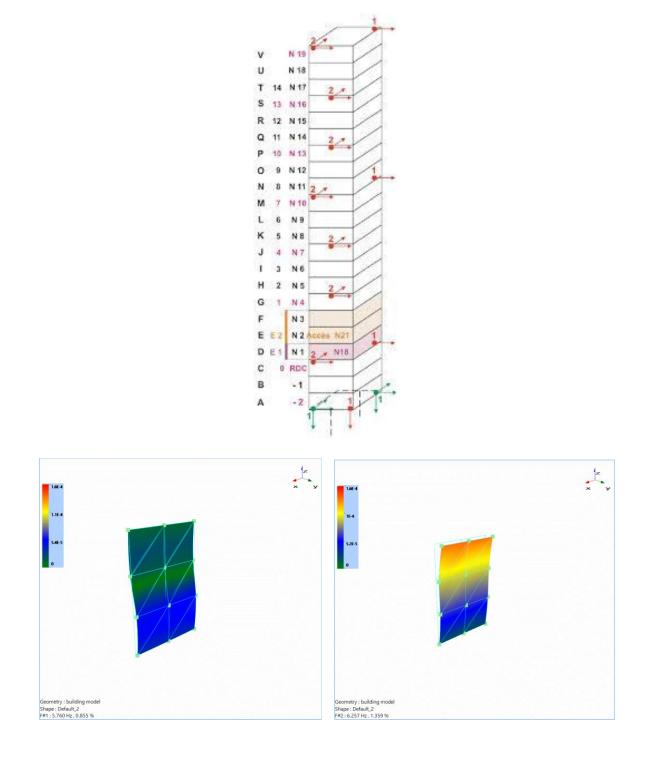






Operational Modal Analysis of Building

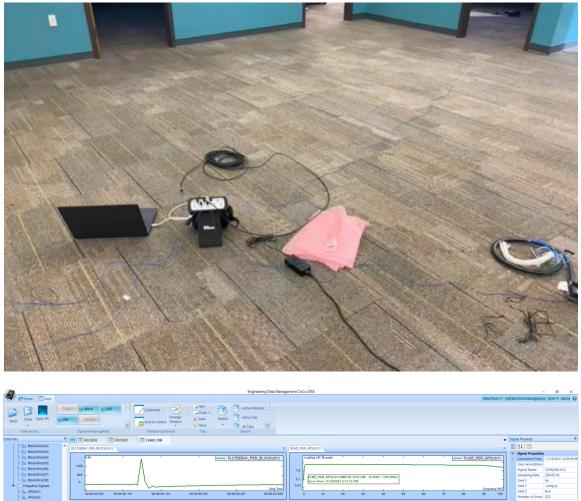
This Canadian customer is executing operational modal analysis using Crystal Instruments to ensure that their buildings pass the necessary standards.





Modal Survey of Floors

This US customer in the east coast is using a CoCo-80X to study the floor vibrations of a building to better understand the structural properties.





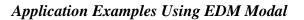


Modal Survey of Engines

An automotive company is using EDM Modal to ensure none of the natural frequencies lie within the operating Engine RPM.



Test Setup Control Testing Plan View Layou							Logged in as [Admin] Logget Hide/Show
ecent tests	Geometry Editor 🔤 In	out Channel Setup	Contract Char	noel Setura 🔲 Score	e 🔲 MIMO FR' Measurem	er 🐺 Madal Data Selection 🐺 B	Dand Selection 🔲 Stability Diagram 🗮 Animation 🗮 Synthesis 🖃 0.05
New Open Properties Delete	Signal candidates for modal			and the			ISIONE HONOMY HEARING
Engine Block vS1 [MIMO FRF]							
033 System (90X-2600416-2596512)	Directions X X Y	NZ KR NT	K P K S	I Display select sig	nal only Validate	Total Count: 28 / 28	LogMag (p/0.8F)
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Modes	H(Ch3,Ch2)(+12+272)	2	+12)+272 +22)+82	(g)/(Newton)	960948	Linear, lines 1800;07 0.976562 Linear, Lines 1800;07 0.976562	
mode	H[Ch4,Ch1][+22+82] H[Ch4,Ch2][+22+272]	121	+ 221+82 + 221+27Z	(g)/(Newton) (g)/(Newton)	5160048	Linear Lines 1800 AF 0.976562	2.21
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🗄 El Model Seminar Hi Test Release Version - (H	H[Ch6(Ch1)]+4Z+82]	12	+47)+87	la)/heaton	5/60048	Linear, Lines 1800 AP 0.976562	1.002-04
🔲 Ci Modal Seminar Hi Test (Hammer impact)	H[CH6,CH2][+42+272]	121	+42+272	(g)/(Newton)	SIC0048	Linear Lines 1800 AF 0.976562	
Cillicense Plate Hammer Impact 1528 Test Co	High7, ch1)(-52+82)	14	+ 52)+ 82	(giv/Newton)	5160048	Linear Lines 1900 ΔF 0.976562	, Preque
	HICH7.Ch2II-52+2721	14	+52)+272	(giv/Newton)	5160048	Uneer.Unes 1000 AF 0.976562	Flace (Degree) SIGD048_H(Ch8,Ch1)(+6Z+I
+ >	H(Ch1Ch1)+62+67	12	+62:+82	(g)/Newton)	5(60048	Lineactines 1000 AF 0.976552	
🔁 🔹 Live Signahi Ran Foldersi Data Fres	H[CH8;Ch2][+62+272]	12	+62:+272	(g)/(Newton)	5160048	Linear, Lines 1800;47 0.976562	126
Time Streams	H(Ch9.Ch1)[+72+82]	128	+72+82	(giv/INewton)	SIG0048	Linear, Lines 1800 ΔF 0.976562	
ko chij-tzi	H(Ch9,Ch2)(+7Z+27Z)	141	+72)+27Z	(g)/(Newton)	5(00048	Linear, Lines 1800, ΔF 0.976562	
- Kn (h21-272)	H(Ch10.Ch1)(+62+62)	14	+02>+02	(giv(Newton)	5160048	Unear, Unes 1000.07 0.976362	
120_CH3[+12]	H[CH10[Ch2][+87+277]	12	+87:+777	(g)/(Newton)	\$160048	Linew, Lines, 1800, AF 0.976562	
20. CMI+221	H(CH11,CH1)(+92+82)	12	+92+82	(a)/(Newton)	5IC0348	Linear, Lines 1800/JF 0:976562	-131
- ko (nsj-32)	H(Ch11,Ch2([+92+272]	[28]	+ 9Z+ 27Z	(giv(Newton)	SIG0048	Linear, Lines 1800, ΔF 0.976562	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
121 Ch6(+32)		14	+102)+8Z	(g)/(Newton)	SIG0048	Unear,Unes 1000,ΔF 0.976362	Freque
201 CHE - 42]	H(Ch12,Ch2(+102+272)		+102+272	(g)/(Newton)	5160048	Unear,Unes 1000,07 0.976562	0 500 1000 1500
- Ko Chal+621	H[CH13]CH1][+112+82]		+112+8Z	(g)/(Newton)	516(0)48	Lineur, Lines 1830, AF 0.976562	
- tro, crei - 72)	H(Ch13,Ch2)(+112+272)		+112+272	(giv(Newton)	5IC0348	Linear,Lines 1800, ΔF 0.976562	GeometryDapity
- [M] (M] + 87]	H(Ch14,Ch1)[+12Z+8Z]		+12Z+8Z	(giv(Newton)	SIG0048	Linear, Lines 1800, ΔF 0.976562	
- <u>PA</u> Chill(+82) - Ko Chill(+82)	H[Ch14,Ch2][+122+272]		+122+272	(g)/(Newton)	SIG0048	Unew, Unes 1000, 07 0.976552	Zoom in Zoom Out Auto Scale Rotate Translate Point Line Surface Model Display Origin Save Image
- m: cn11[+32] - h: cn12[+32]	H[Ch15[Ch1][+152+82]		+1525+8Z	(g)/(Nexton)	5160048	Linew, lines 1800,07 0.976562	View Display Settings • Utilities
ko contenta	H(Ch15,Ch2)(+132+272)		+132+272	Egiv(Newton)	SIG0348	Linear, Lines 1800, ΔF 0.976562	
	H(Ch16,Ch1)[+14Z+8Z]		+142+8Z +142+27Z	(g)/(Newton)	SIG0048	Linear, Lines 1800, ΔF 0.976562	Perspective
24, Ch14[+122]	H(Ch16,Ch2(+14Z+27Z)	141	+142)+272	(g)/(Newton)	SIG0048	Unear,Unes 1800,ΔF 0.976962	
-1/2 Ch15[+132]							
(<u>ko</u> ch16(+142)							
📟 Time Blocks							
- M. Block(Ch1)[+82]							
- <u>1v</u> Block(Ch2)(+27Z)							
24: Block(Ch3)[+12]							
- [2], Block(Ch4)[-22]							
1 Slock(Lhb)[+52]							
ko, Block(ChC)[+42]							
- [//; Block(Ch7)[+52]							
- <u>[vi</u> Block(Lh8)(+62)							
24. Block(Ch9)[+72]							
[h] Block(Ch10](+82)							
<u>[27]</u> Block(Ch11)(+92)							
200_Block(Ch12)(+102)							Barto
[ki] Block(Ch13)[+112]							
(<u>M</u>) Block[Ch14](+122]							Geometry : Default Geometry

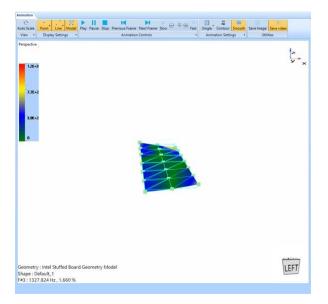


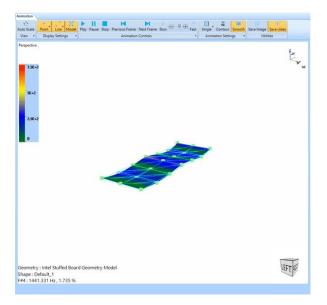


Modal Analysis of Stuffed Printed Circuit Boards

A semiconductor chip manufacturer in the bay area of California is using a Spider80X and EDM Modal to ensure that the stuffed board with capacitors and other components does not have any resonances in the desirable frequency range as it can have an undesirable effect on the device in which it is installed.





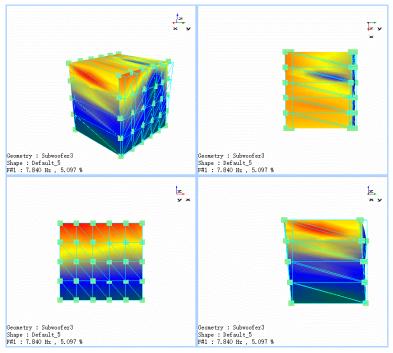




Modal Analysis of Smart Speakers

A big company in Silicon Valley that specializes in software, hardware, search engine is using Spider-80X and EDM Modal for modal analysis of their smart speakers.

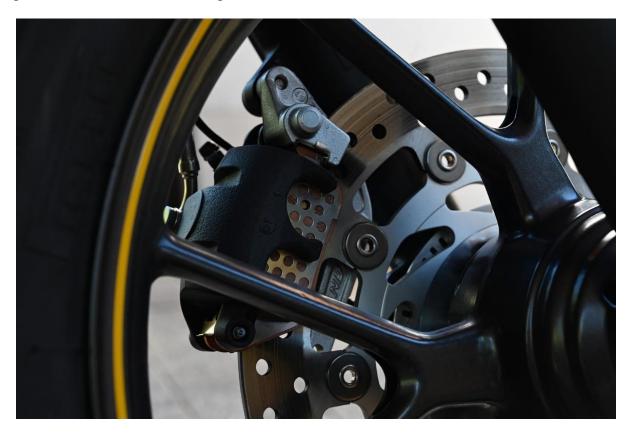


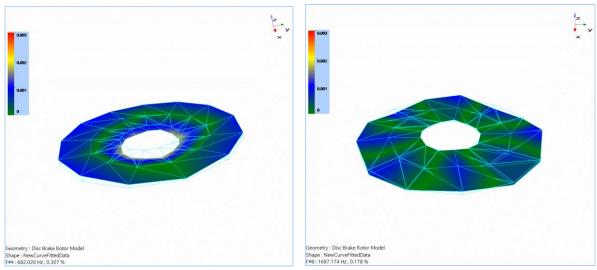




Modal Analysis of Brake Discs

A brake manufacturer is using Spider80X and EDM Modal to ensure that the natural frequencies of their disc brake rotor are not close to one of the excitation frequencies during braking. A brake squeal could introduce a lot of unpleasant vibration and noise.

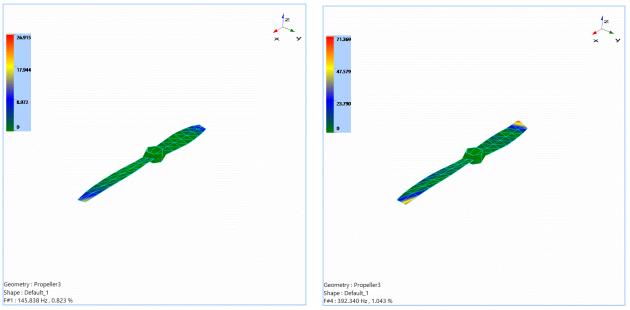






Modal Analysis of Propellers A customer is using Crystal Instruments system for modal testing and analysis of their aircraft propeller.



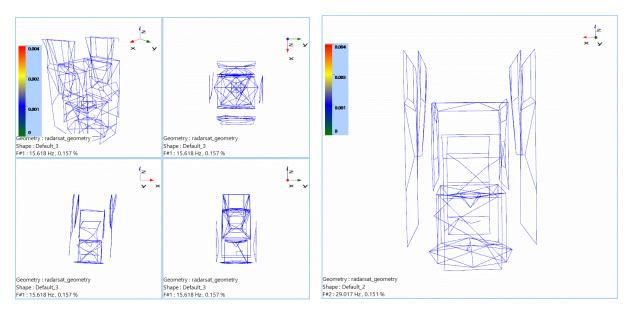


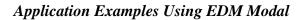


Modal Analysis of Satellite

One of our customers is using Crystal Instruments hardware system along with EDM Modal to execute modal testing and analysis on their satellites.





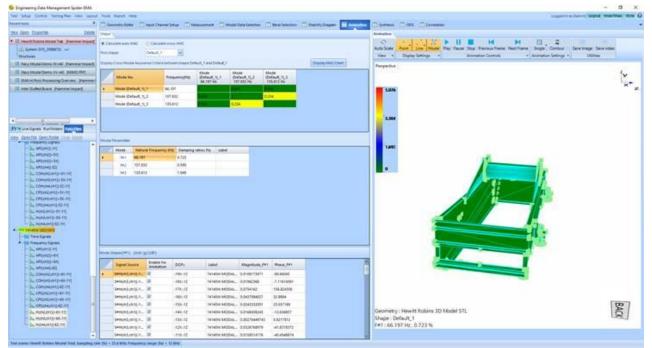


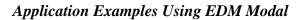


Modal Analysis of Factory Machinery

A customer in UK is using CoCo-80 and EDM Modal from Crystal Instruments to perform modal analysis of their factory machinery.





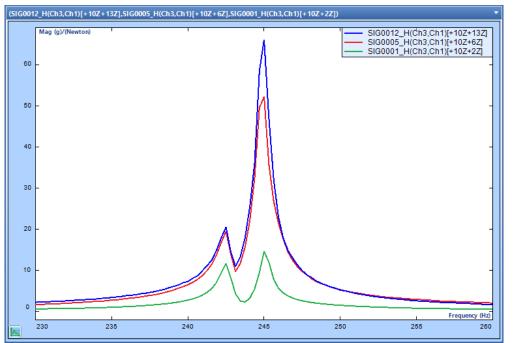




Modal Analysis of Actuator

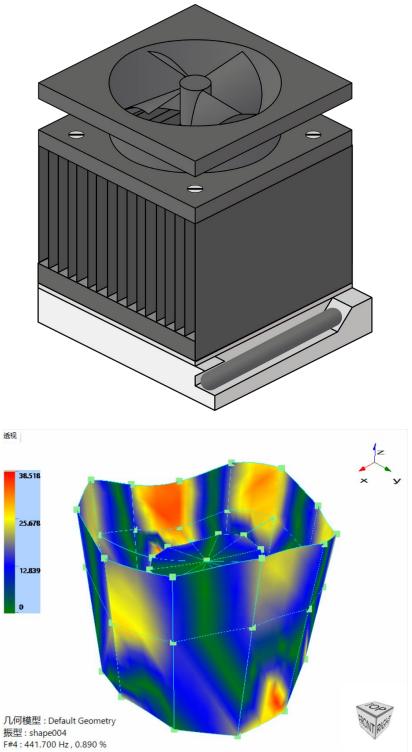
Another US east coast customer is using Crystal Instruments' Modal package for obtaining FRFs of their actuator.

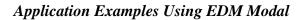






Modal Analysis of Cooling System An overseas customer is using Spider 80X and EDM Modal to execute modal analysis of their cooling system.

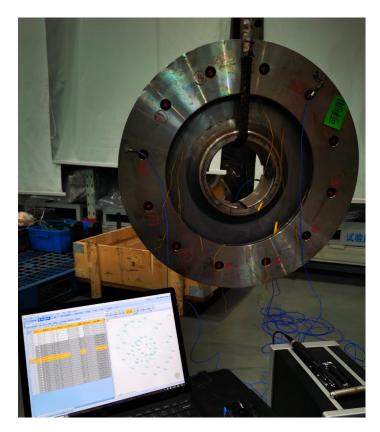


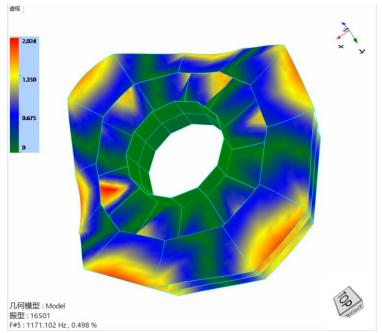




Modal Analysis of Train Brake Disc

Another international customer is using Crystal Instruments' Modal package for executing modal analysis of their train brake disc.



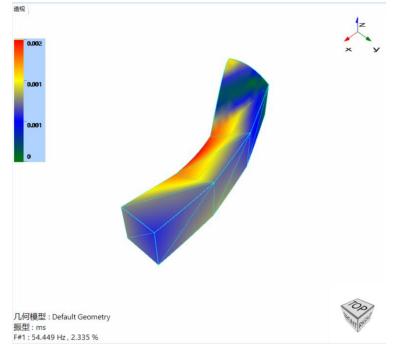


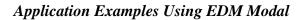


Modal Analysis of Head Light Assembly

An automotive customer is using Crystal Instrument's EDM Modal and hardware system to carry out modal testing and analysis of their headlight system assembly.



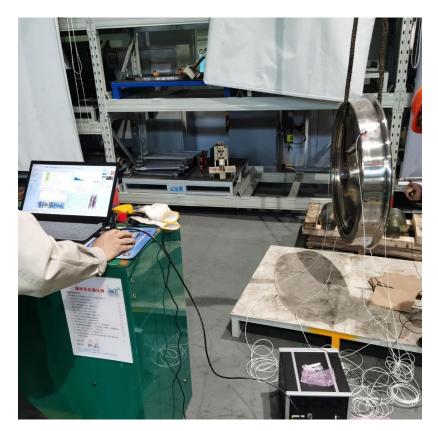


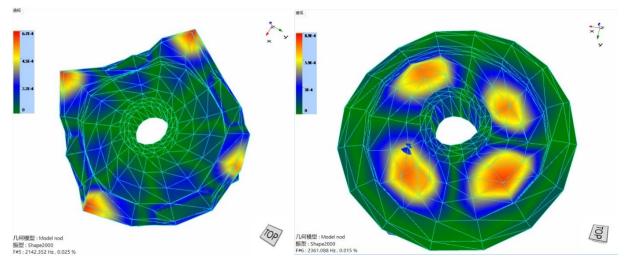




Modal Analysis of Locomotive Wheel

An international customer is using Crystal Instruments' Modal package for modal testing and analysis of their locomotive wheel.



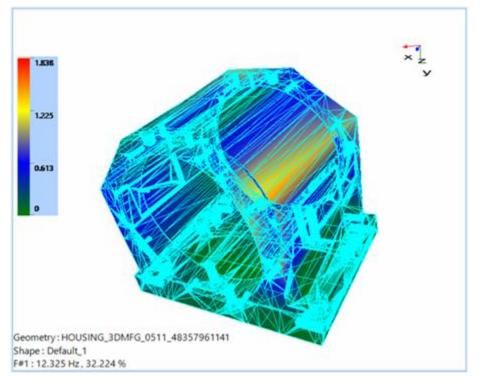




Modal Analysis of Machinery

Another international customer is using CoCo80X and EDM Modal for modal testing and analysis of their machinery.



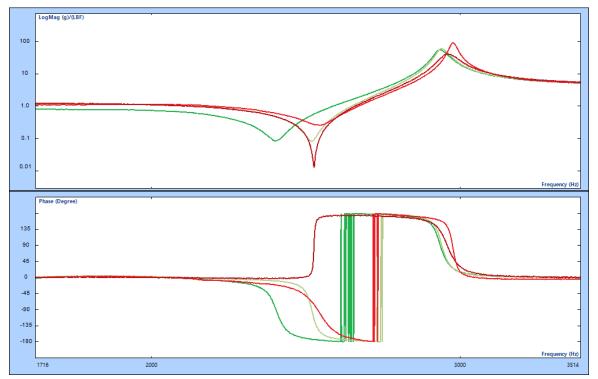




Modal Analysis of Gun Barrel Parts

A US east coast customer is using EDM Modal to qualify raw materials for their gun barrels.

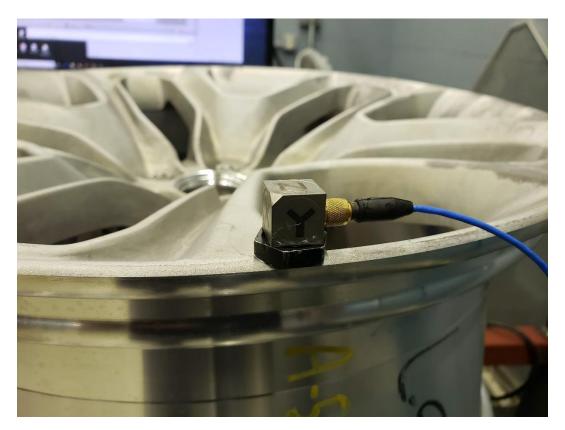




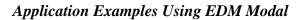


Modal Analysis of Car Wheel

Another customer in Southern California is using Crystal Instrument's Modal solution package for acquiring FRFs of their automotive wheels.



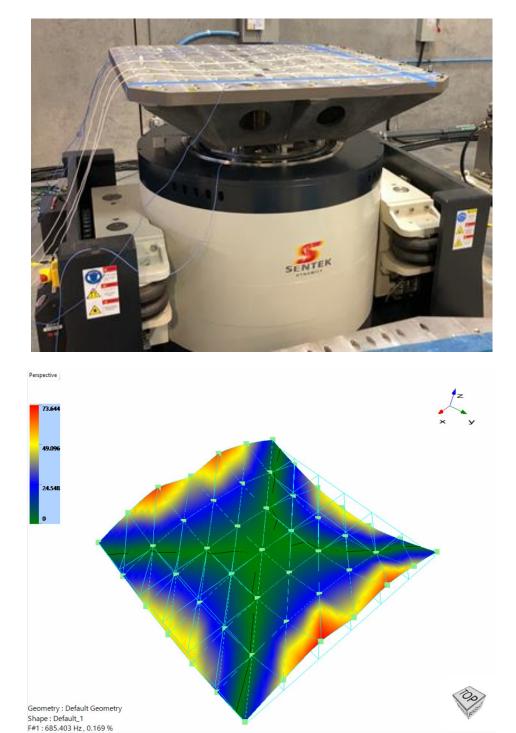


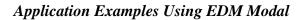




Modal Analysis of Shaker Head Expander

Another customer who actually uses our vibration controller is executing modal analysis of their head expander to ensure that the modes do not lie within the desired frequency range.



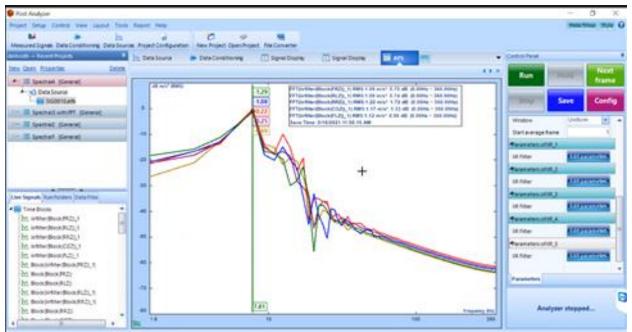




Modal Analysis of Gantry Crane

Another customer in the east coast of US is using Crystal Instruments' Modal package for measuring and analyzing the resonances of their gantry crane.



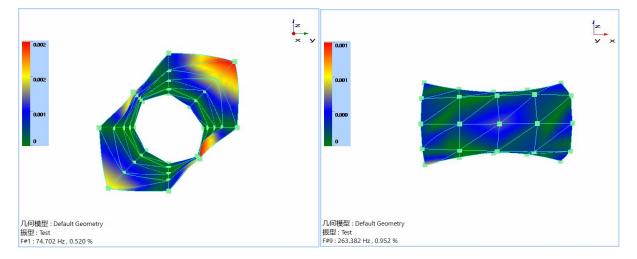


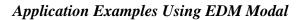


Modal Analysis of MRI Carrier

Another customer of ours is using Crystal Instruments' Modal package for measuring and analyzing the resonances of the carrier in MRI machine to help identify weak links.







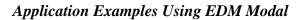


Modal Analysis of Baseball Bat

Another US customer is using Crystal Instruments' Spider80X and EDM Modal for identifying the sweet spot of their baseball bats.



st Setup Control Testing Plan View Layou cent tests #		neut Channel Cot	(T) Manager	a management	Televise III	d fatation T Dabits Discon	Logged in as [4dmin] Logged Hide:	Laron [ach
w Open Properties Delete	Signal candidates for modal		- C) measurenne			a selection 🔄 stationly program 🔄	SIG0011_HICH3_CH1[+322+102[SIG0002_HICH2_CH1]+22+12[SIG0003_HICH2_Ch1]+22+22[SIG0004_HICH2_Ch1]+22+32] etc(240]	
Baseball Bat Hammer Impact Modal Test 1								
U System (5Y5_2588672) ~P	Directions Z X Z Y	WZ WR WI	r VP VS	Display select si	ignal only	Validate Total Count: 20 / 2	40 LogMag (g) (Newton)	
Structures	Signal Name	Calculate Modal	DOES	Unit	Signal Source	Compatibility	- 10 - 1	
Default_1					-	companions		
Shape Tables	H(Ch2,Ch1)[+2Z+12]	12	+12:+22 +12:+322	(g)/(Newton)	\$1G0002 \$1G0002			al-C
Default 1	H[Ch3,Ch1][+32Z+1Z]	2		(g)/(Newton)	SIG0002 SIG0003			
Default 2	H(Ch2,Ch1)[+2Z+2Z]	100	+22:+22	(g)/(Newton)				1.144
Detault, 3	H[Ch3,Ch1)[+322+22]	92	+22)+322	(g)/(Newton)	\$IG0003			11
Default 4	H[Ch2,Ch1][+2Z+3Z]		+32:=2Z	(g)/(Newton)	51G0004		DODY HALF AND A LONG AND A	
Default 5	H(Ch3,Ch1)[+32Z+3Z]	2	+ 32:+ 322	(g)/(Newton)	5IG0004		1.005-04	
Default_6	H[Ch2,Ch1)[+2Z+4Z]	192	+42:+22	(g)/(Newton)	\$1G0005		1.005-05	
	H[Ch3,Ch1)[+32Z+4Z]	15	=4Z:=32Z	(g)/(Newton)	\$IG0005			Frequency
RADARSAT Data [Hammer Impact]	H[Ch2,Ch1][+2Z+5Z]	90	+5Z:+2Z	(g)/(Newton)	\$1G0006		Phase (Degree)	
	H[Ch3,Ch1][+32Z+5Z]	140	+52:+32Z	(g)/(Newton)	51G0006			-
Common A	H[Ch2,Ch1)[+2Z+6Z]	22	+62:-2Z	(g)/(Newton)	SIG0007			
Live Signals Run Folders Data Files	H[Ch3,Ch1][+32Z+6Z]	100	-62:-322	(g)/(Newton)	51G0007			
Default Folder Dec 17, 2021 12-32-10	H[Ch2,Ch1][+2Z+72]	20	+72=2Z	(g)/(Newton)	SIG0008			AN URA
/AW 5IG0129 Dec 21, 2021 15-43-28	H[Ch3,Ch1][+32Z+7Z]	12	=7Z=32Z	(g)/(Newton)	\$1G0008			
/## 5iG0128 Dec 21 2021 15-42-42	H[Ch2,Ch1][+2Z+8Z]	38	+82:+22	(g)/(Newton)	5IG0009			
/## SIG0127 Dec 21, 2021 15-41-39	H[Ch3,Ch1][+32Z+8Z]	12	+8Z=32Z	(g)/(Newton)	\$IG0009			
/## SIG0126 Dec 21, 2021 15-40-19	H(Ch2,Ch1)[+2Z+9Z]	120	+92:+22	(g)/(Newton)	SIG0010			A IN F
(AN) 51G0125 Dec 21, 2021 15-36-22	H[Ch3,Ch1][+32Z+9Z]	121	+9Z:+32Z	(g)/(Newton)	SIG0010			
/## 5/60124 Dec 21 2021 15-34-54	H[Ch2,Ch1][+2Z+10Z]	120	+102:+22	(g)/(Newton)	SIG0011			Frequenc
MV 5IG0123 Dec 21, 2021 15-33-55	H[Ch3,Ch1][+32Z+10Z]		+ 102:+ 322	(g)/(Newton)	SIG0011		0 500 1000 1500 2000 2500 3000	
	HICh2,Ch1)[+2Z+11Z]	123	+11Z+2Z	(g)/(Newton)	SIG0013			
(AN) SIG0122 Dec 21, 2021 15-33-12	H Ch3,Ch1)[+32Z+11Z]	20 A	-11Z:+32Z	(g)/(Newton)	SIG0013		Geometry Display	
//// 5iG0121 Dec 21, 2021 15-32-28	H[Ch2,Ch1][+2Z+12Z]	101	+122+22	(g)/(Newton)	5IG0014			
(AN) SIG0120 Dec 21, 2021 15-31-13	H(Ch3,Ch1)[+32Z+12Z]	10	+122:+322	(g)/(Newton)	\$IG0014		Zoom In Zoom Out Auto Scale Rotate Translate Point Line Surface Model Display Origin Save Image	
/ANV SIG0119 Dec 21, 2021 15-29-10	H(Ch2,Ch1)[+2Z+13Z]	10	+132:+22	(g)/(Newton)	\$IG0015		View Display Settings • Utilities	
/All 51G0118 Dec 21, 2021 15-28-15	H(Ch3,Ch1)[+32Z+13Z]	10	+132:+322	(g)/(Newton)	SIG0015		view Uspay settings • Unities	
74W SIG0117 Dec 21, 2021 15-27-02	H(Ch2,Ch1)[+2Z+14Z]	12	-14Z+2Z	(p)/(Newton)	SIG0016		Perspective	
/MV 5IG0116 Dec 21, 2021 12-24-00	H[Ch3,Ch1][+32Z+14Z]	23	+142+322	(g)/(Newton)	SIG0016			1
/## 5IG0115 Dec 21, 2021 12-22-53	H[Ch2,Ch1][+2Z+15Z]	20	- 152:+ 22	(g)/(Newton)	SIG0017			Y
/AW 5IG0114 Dec 21, 2021 12-21-37	H[Ch3,Ch1][+322+152]	10	+152:+322	(g)/(Newton)	SIG0017			-
AND SIG0113 Dec 21, 2021 12-20-17	HICh2,Ch1][+22+162]	23	= 16Z:= 2Z	(g)/(Newton)	SIG0018			~
MM SIG0112 Dec 21, 2021 12-19-06	H[Ch3,Ch1][+32Z+16Z]	83	+ 162:+ 322	(g)/(Newton)	SIG0018			
AND SIG0112 Dec 21, 2021 12-09-04	HICh2.Ch11[+2Z+17Z]	23	-17Z-2Z	(g)/INewton)	SIG0019			
ANV 5IG0110 Dec 21, 2021 12-06-20	H[Ch3,Ch1][+322+172]	10	+ 172:+ 322	(g)/(Newton)	5IG0019			
	H[Ch2,Ch1][+2Z+182]	20	-182:+22	(g)/(Newton)	51G0020		1993 A.	
AND 51G0109 Dec 21, 2021 12-02-33	H[Ch3,Ch1][+322+182]		+ 182:+ 322	(g)/(Newton)	51G0020		A REPAIL	
/4N/ 5IG0108 Dec 21, 2021 11-59-18	HICh2.Ch111+2Z+19Z1	-	+ 19Z-2Z	(g)/(Newton)	SIG0021			
ww SIG0107 Dec 21, 2021 11-58-05	HICh3.Ch1[+322+192]	-	+ 192:+ 322	(g)/(Newton)	5IG0021			
/4% SIG0106 Dec 21, 2021 11-55-36	H[Ch2,Ch1][+2Z+20Z]	10	+202:+22	(g)/(Newton)	5IG0022			
AND SIG0105 Dec 21, 2021 11-51-42	HiCh3.Ch11[+322+202]	-	+202:+322	(g)/(Newton)	5160022			
/## 5IG0104 Dec 21, 2021 11-50-35	H[Ch2,Ch1][+2Z+212]	100	+212:+22	(g)/(Newton)	SIG0023			
(AND SIG0103 Dec 21, 2021 11-49-46	H[Ch3,Ch1][+32Z+21Z]	10	+212:+322	(g)/(Newton)	SIG0023			
AM SIG0102 Dec 21, 2021 11-48-40	Hich3.Ch1][+322+212] HiCh2.Ch1[+2Z+222]	-	+212+322 +222:+22	(g)/(Newton)	51G0024		P P P P P P P P P P P P P P P P P P P	STO
/880 SIG0101 Dec 21, 2021 11-47-41	HiCh3.Ch1][+22+222] HiCh3.Ch1][+32Z+222]		+222+322		SIG0024			RZ
//// SiG0100 Dec 21, 2021 11-46-03	H(Ch3;Ch1)[+322+222] H(Ch2;Ch1)[+22+232]	24	+22C+32L +232:+2Z	(g)/(Newton)	SIG0024 SIG0025			814
100 5160099 Dec 21, 2021 11-46-03	HICh2,Ch1][+2Z+232] HICh3.Ch1I[+32Z+232]	10	+232:+22 +232:+322	(g)/(Newton) (g)/(Newton)	SIG0025 SIG0025		Geometry : Bottomo-Up Baseball Bat Model	Ψ

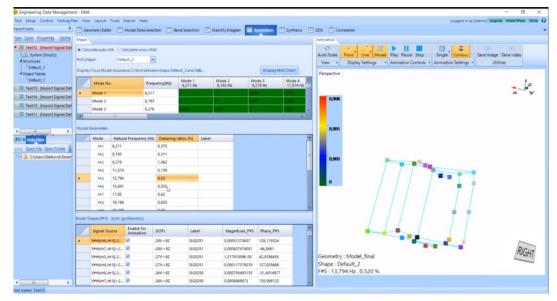




Modal Analysis of Processing Equipment

Another customer in South Africa is using Crystal Instruments' CoCo-80X and EDM Modal to measure the resonances of their mineral processing machinery.



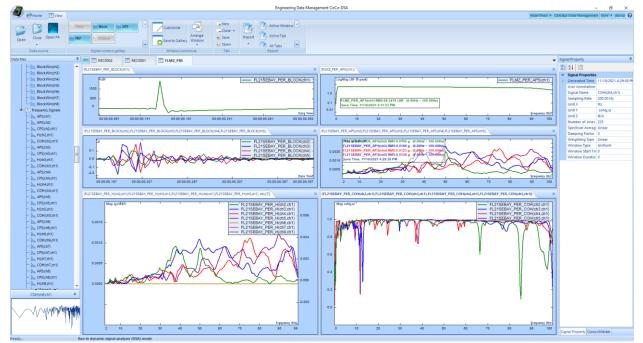




Modal Analysis of Road Pavements

An overseas customer is using CoCo-80X and EDM Modal to measure the resonances of their road pavements.

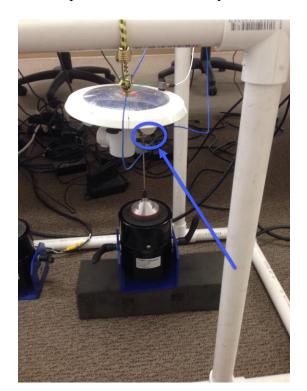


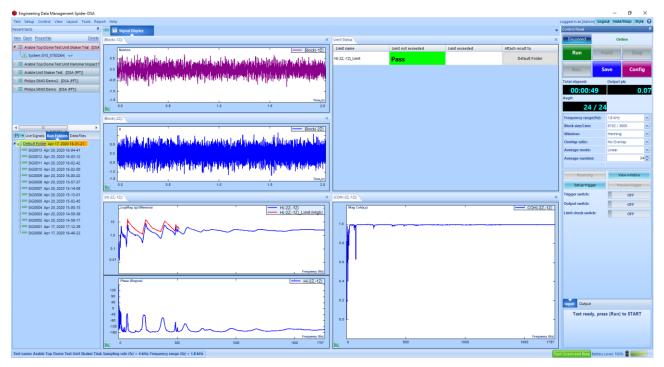


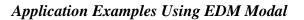


Modal Analysis of Rain Drop Sensor Assembly

A bay area customer in California is using Crystal Instruments' Modal solution package for acquiring the FRFs of their rain drop sensor dome assembly.



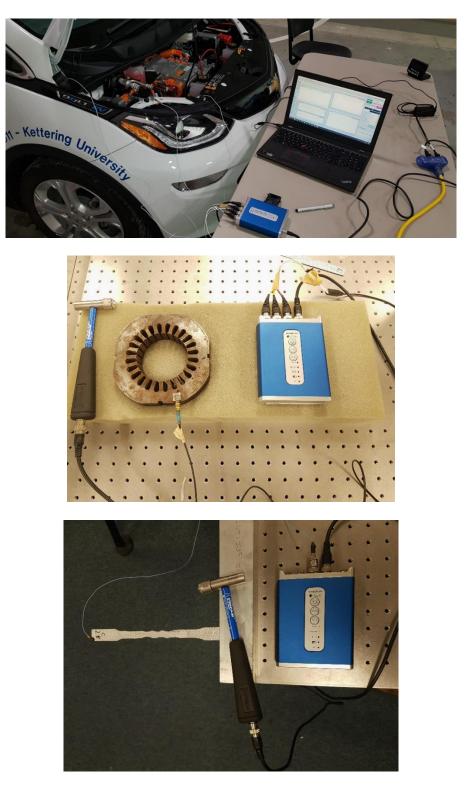






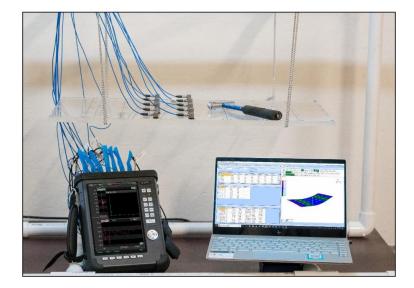
Modal Analysis of Academic Structures in Universities

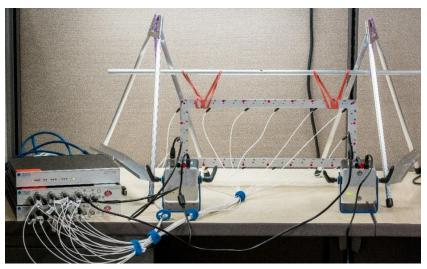
Crystal Instruments works with various universities for their research projects in the field of modal analysis.





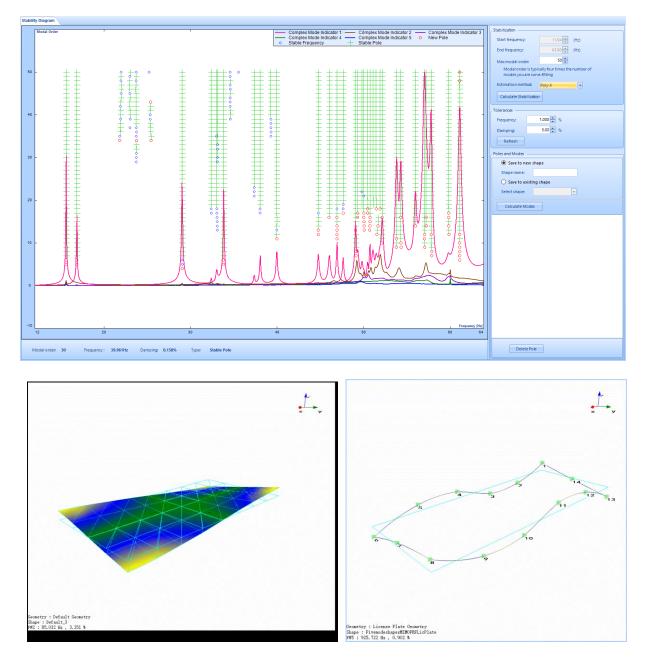
Application Examples Using EDM Modal











Some of the interesting cases illustrated here demonstrate the practical use and application of modal testing and analysis on various industrial and academic structures. The results emphasize the strength, simplicity, and efficiency of EDM Modal to execute sophisticated modal tests on intricate and complex structures.