EDM Modal

Engineering Data Management Software – Modal Analysis

CRYSTAL INSTRUMENTS

FEA Model Validation Using EDM Modal

EDM Modal Introduction

Topic 1

Topic 2

Topic 3

Overview/Discussion of CI has created and why…

CRYSTAL INSTRUMENTS

Some Engineering Benefits of EDM Modal

- Allows engineers to quickly understand vibration characteristics before investing in expensive 3D analyses
- Frequencies and mode shapes can be experimentally determined without needing detailed 3D models or finite element analysis
- Is an excellent tool to help verify FEA models accurately simulate the physics

EDM Modal & Finite Element Analysis Comparisons

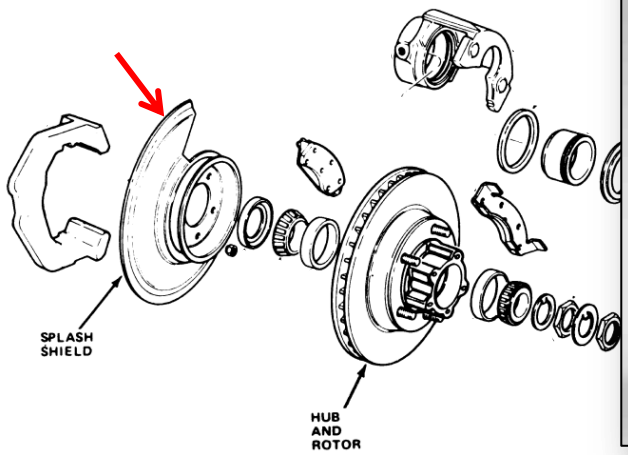
Disk Rotor Splash Shield Modal Analysis Example

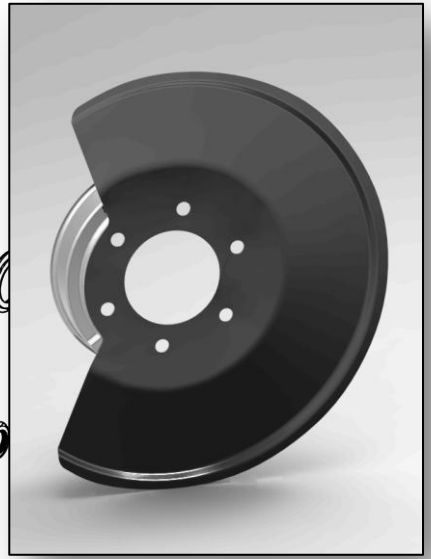
Objective:

Determine the lowest frequency and mode shape using EDM Modal & Finite Element Analysis (FEA)

FEA Challenges:

- Modeling accuracy is critical since frequencies are sensitive to thin part tolerances
- Forming process causes non-uniform thinning in various zones that can be difficult to model
- Part is not a perfect revolution and has bends – requiring 3D Laser Scanning to create geometry

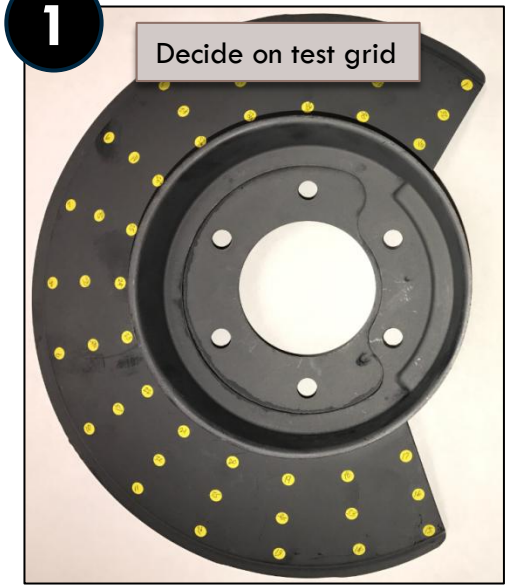




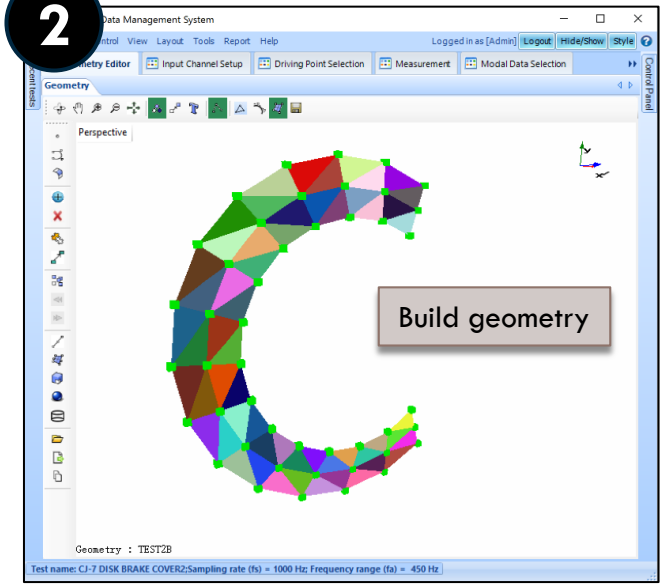
EDM Modal offers direct results without any of the FEA challenges

EDM Modal Evaluation Process

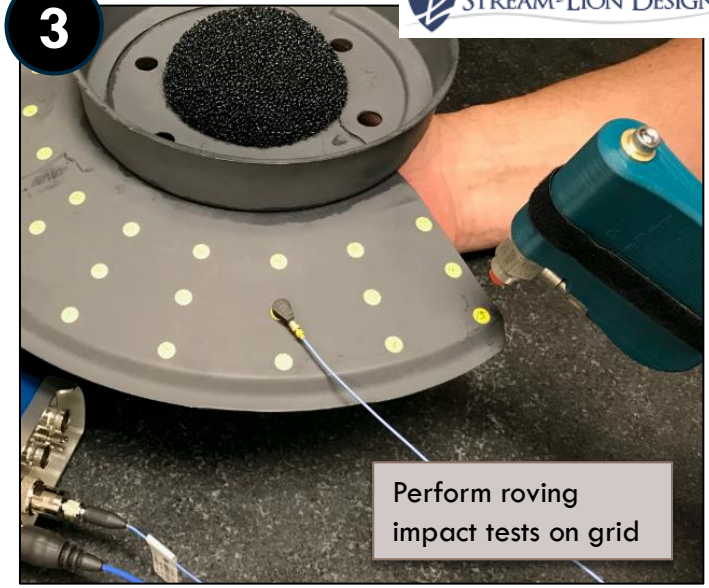
1



2



3

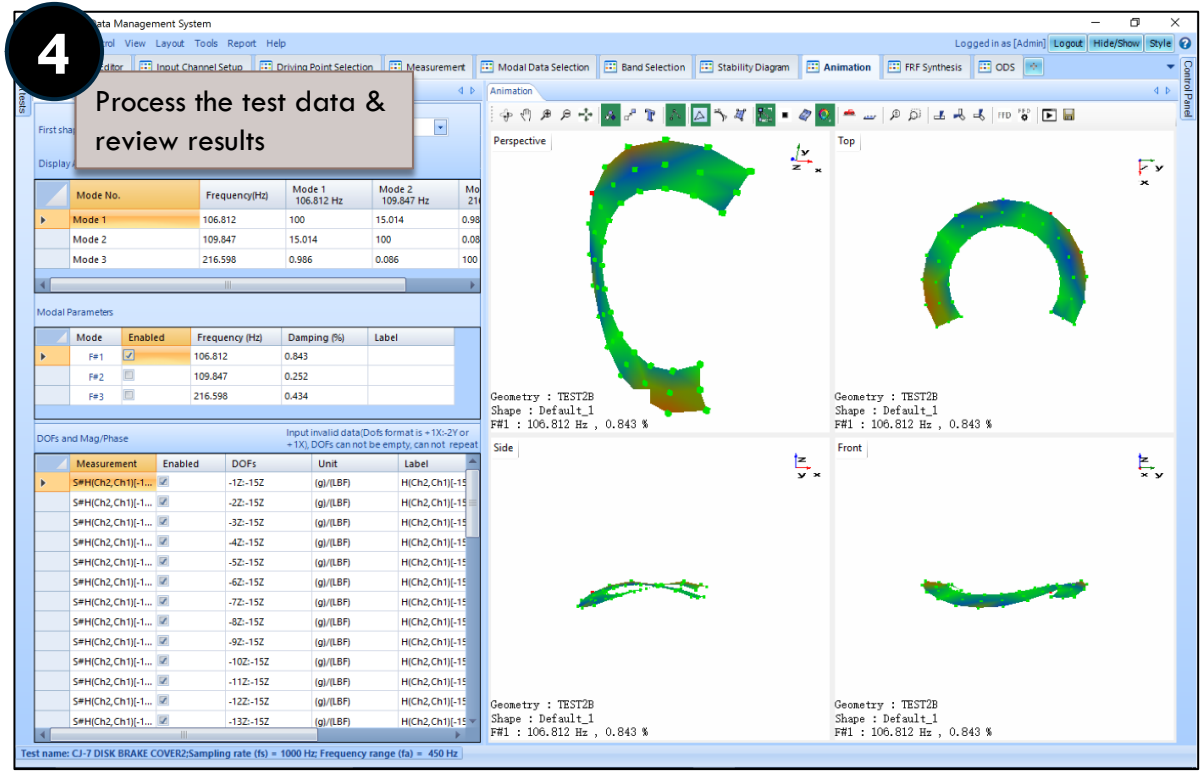


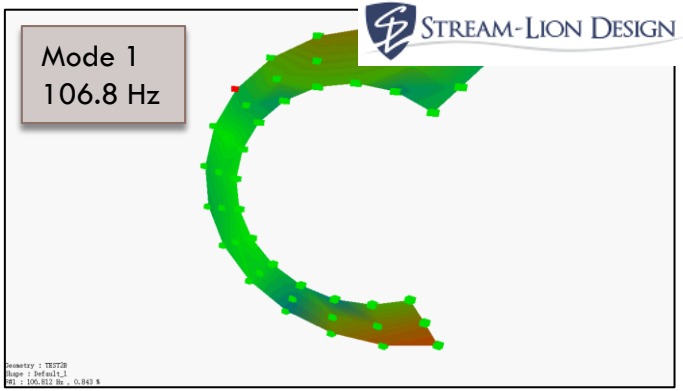
Once test is started, EDM Modal directs the test sequence while performing internal data quality checks to insure best accuracy.

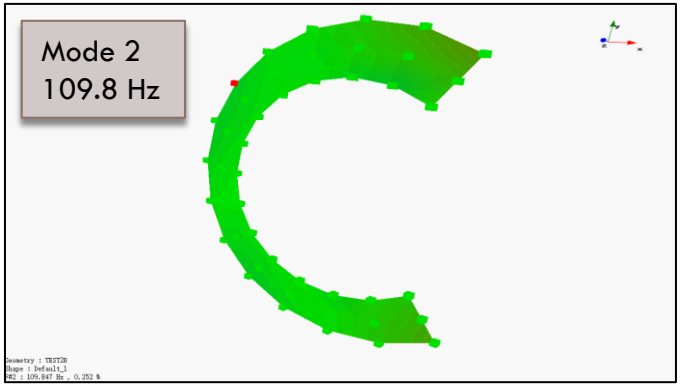
EDM Modal Results

4

Process the test data & review results





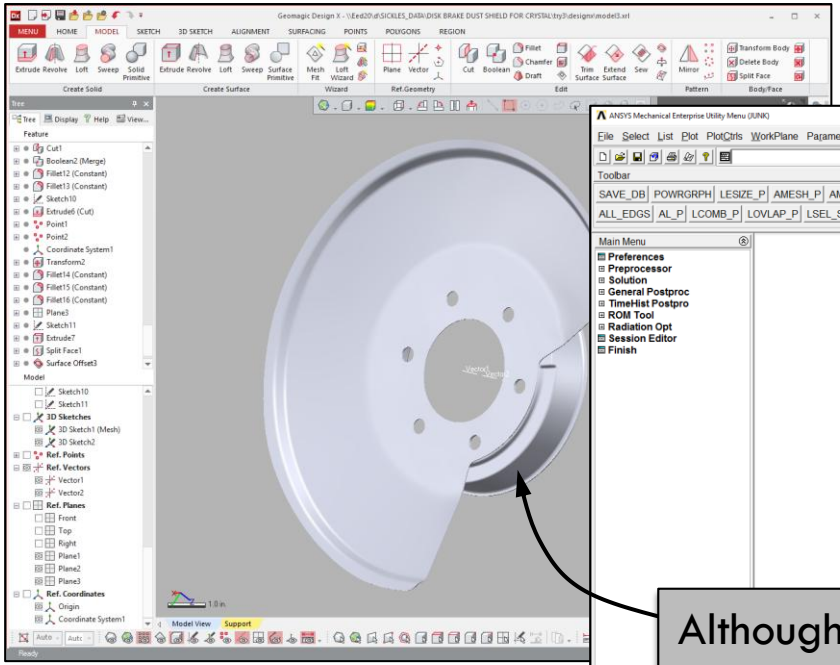


STREAM-LION DESIGN

CRYSTAL INSTRUMENTS

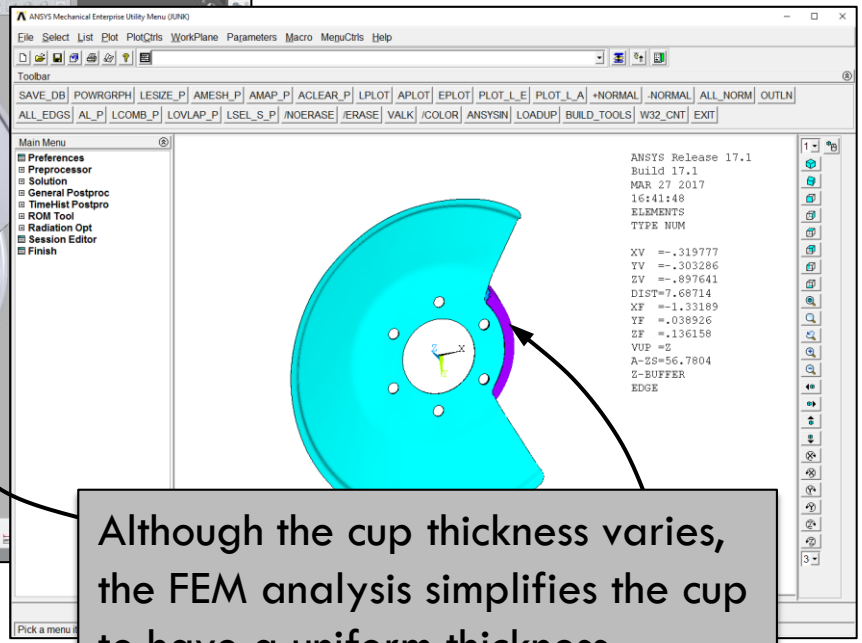
Finite Element Analysis for Comparison

Laser Scans



Model from Scans

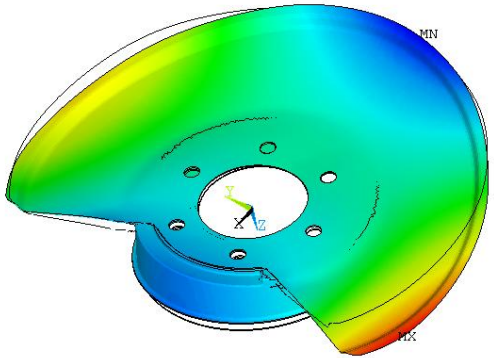
Finite Element Model



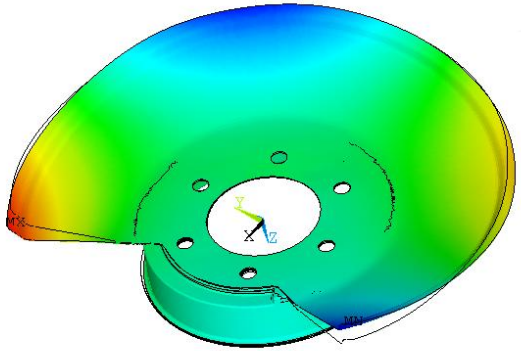
Although the cup thickness varies, the FEM analysis simplifies the cup to have a uniform thickness.

Finite Element Analysis for Comparison

FEM

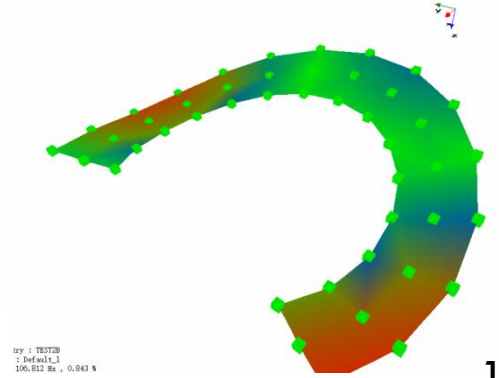


107.7 Hz

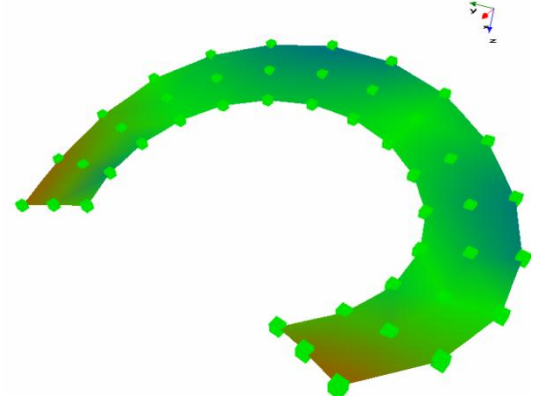


111.7 Hz

EDM
MODAL



106.8 Hz

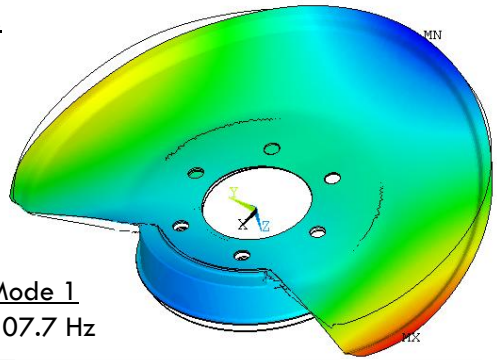


109.8 Hz

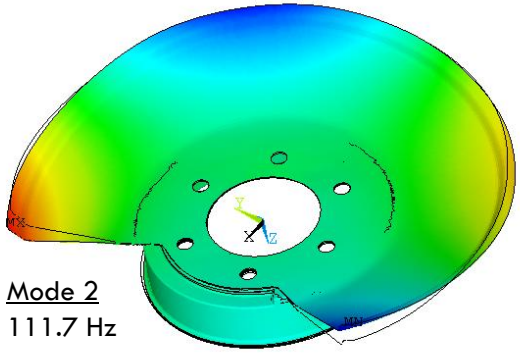
Finite Element Analysis for Comparison

STREAM-LION DESIGN

FEM

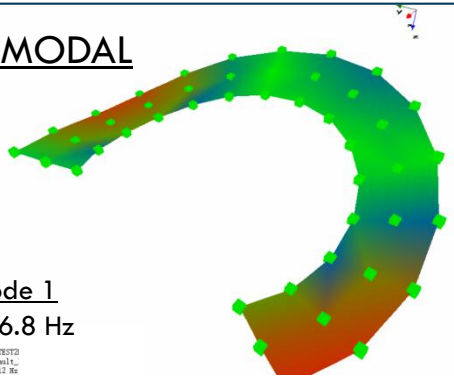


Mode 1
107.7 Hz

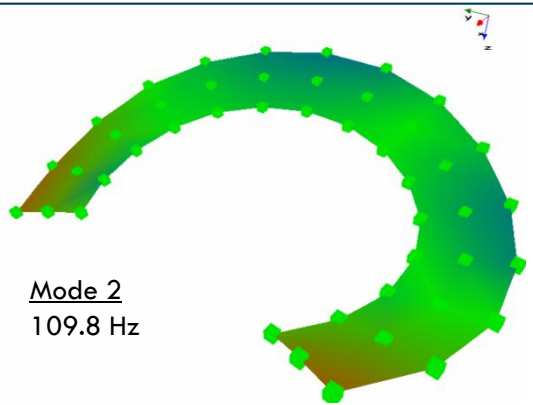


Mode 2
111.7 Hz

EDM MODAL



Mode 1
106.8 Hz



Mode 2
109.8 Hz

MODE	FEM RESULT (Hz)	EDM RESULT (Hz)	FEM DIFF (Hz)	FEM % ERROR
1	108	107	1	1%
2	112	110	2	2%
3	206	219	-13	-6%

- Good comparison between FEM & EDM Modal
- EDM results show that FEM improvements could be made for closer correlation of the higher modes

CRYSTAL INSTRUMENTS

Summary

Excellent comparison between EDM Modal & Finite Element results!

For more information about EDM Modal, contact:

Darren Fraser
Crystal Instruments
2370 Owen Street
Santa Clara, CA 95054
Phone: (408) 986-8880

Example & Modeling Performed by:
Paul V. Sickles, PE
President
Stream-Lion Design, LLC
Stream-Lion.com