

Structural Dynamics and Acoustic Systems Laboratory University of Massachusetts Lowell

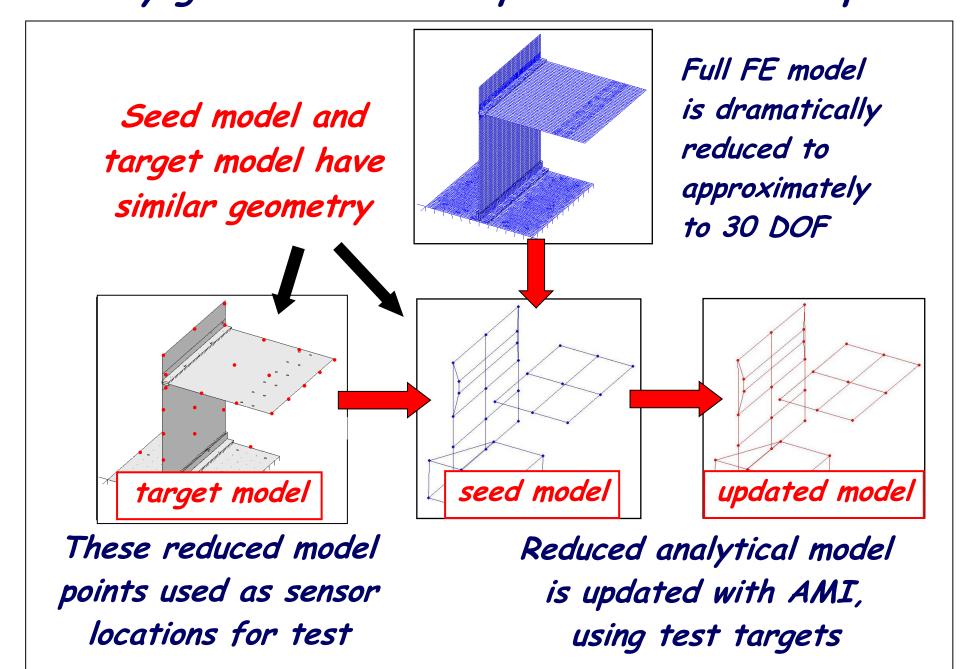


REDUCED ORDER, TEST VERIFIED COMPONENT MODEL SYSTEM METHODS FOR MULTIBODY DYNAMIC SYSTEM APPLICATIONS FOR HELICOPTER/MISSILE/WING CONFIGURATIONS

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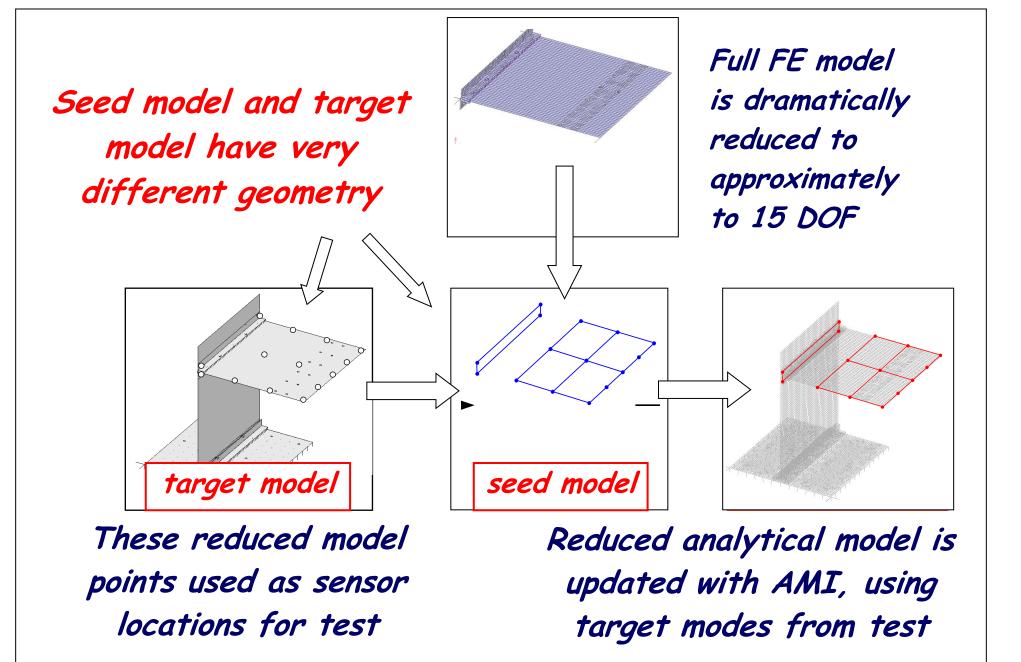
Modal Based System Response - MBSR

Complete System Model Reduction with Direct Updating -Modeling technique usually employed in many instances and provides very good results. Requires full model representation



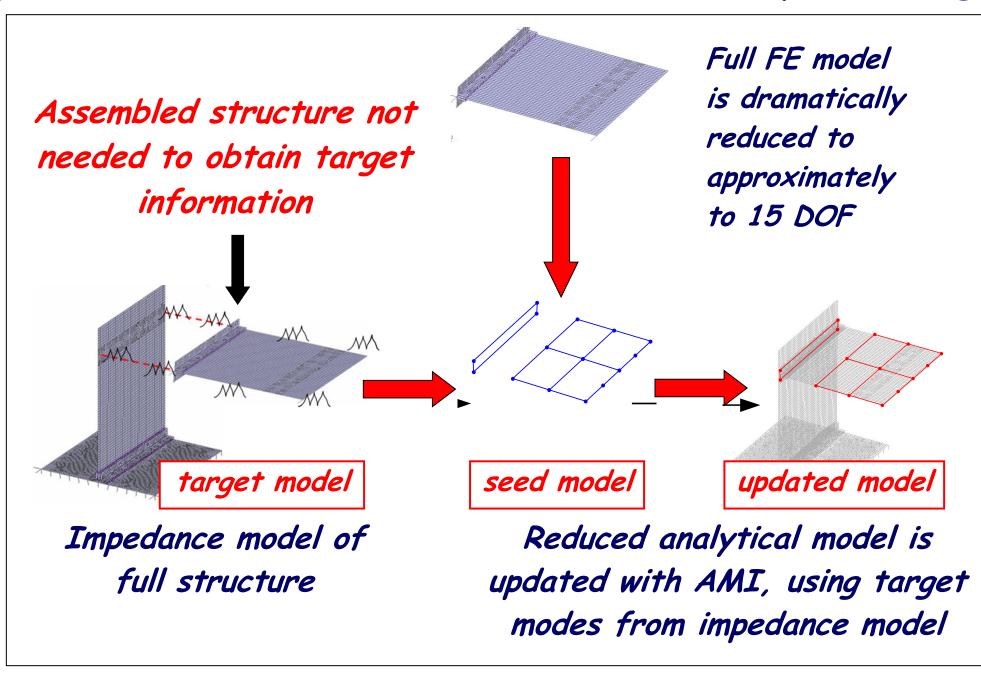
Modal Based Component Response - MBCR

Reduced Component Model Updating from Assembled System
Response - Advantage of technique is that only part of the
structure needs to be modeled (such as component) but direct
model updating is performed using test data from complete
system assembly. This technique requires that the system
targets be obtained from an assembled system



Frequency Based Component Response - FBCR

Reduced Component Model Updating from Impedance Developed Model for System Characteristics - Similar to MBCR but the system targets are obtained from component information used to form a frequency based substructure. This implies that the components do <u>not</u> need to be assembled for system targets

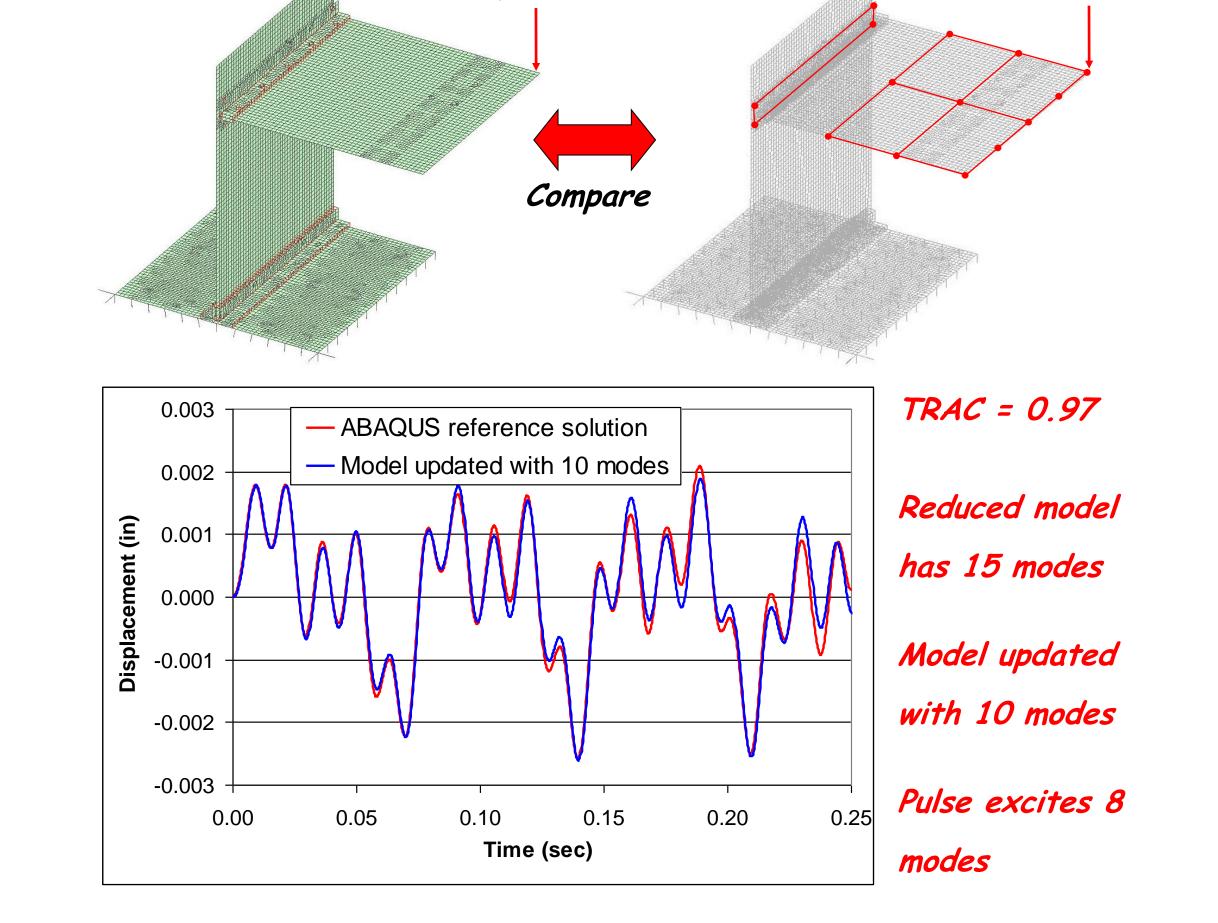


Modal Based System Response - MBSR Modal Based Component Response - MBCR Frequency Based Component Response - FBCR



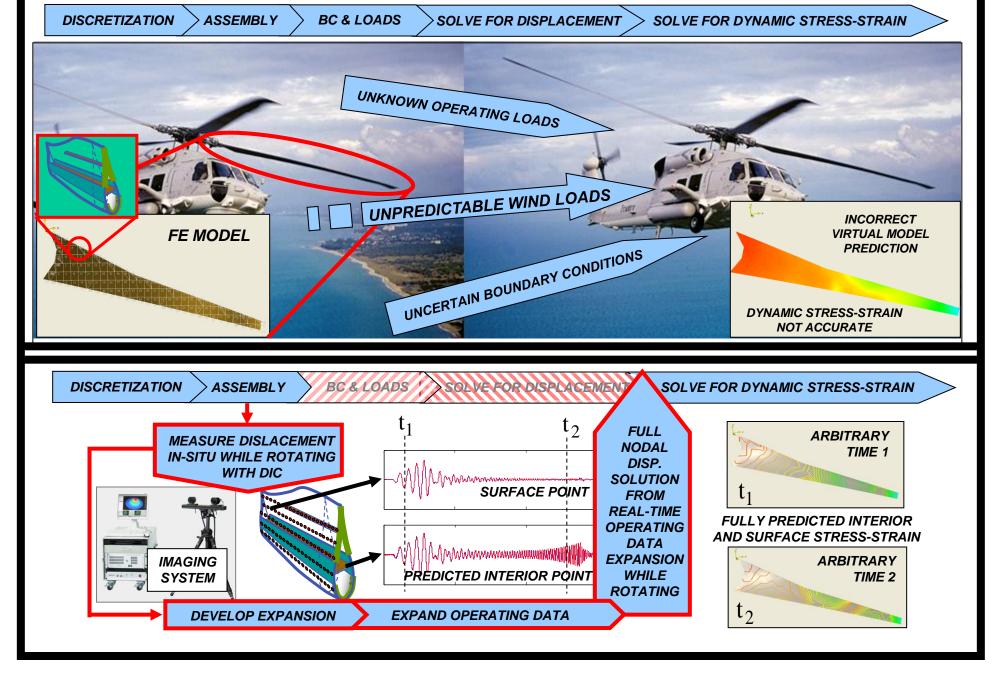
Z_V_X

All three techniques provide very different approaches for solving these complicated problems. All models were checked for both flexibility and dynamic response prediction.



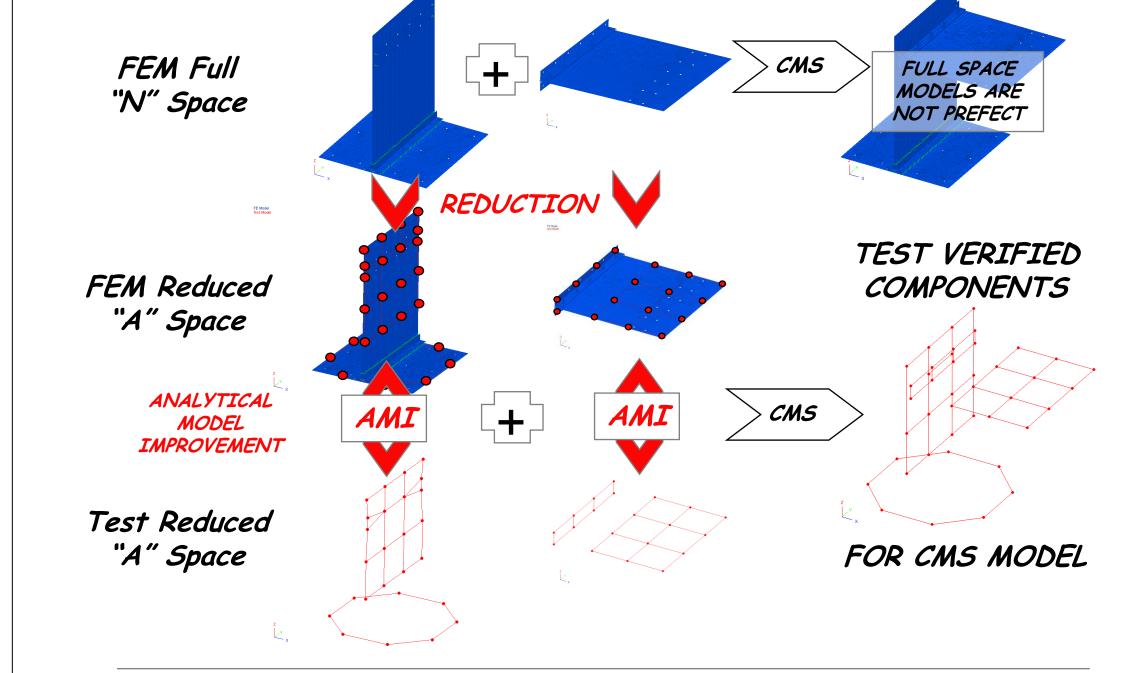
REAL TIME DYNAMIC STRESS-DYNAMIC STRAIN

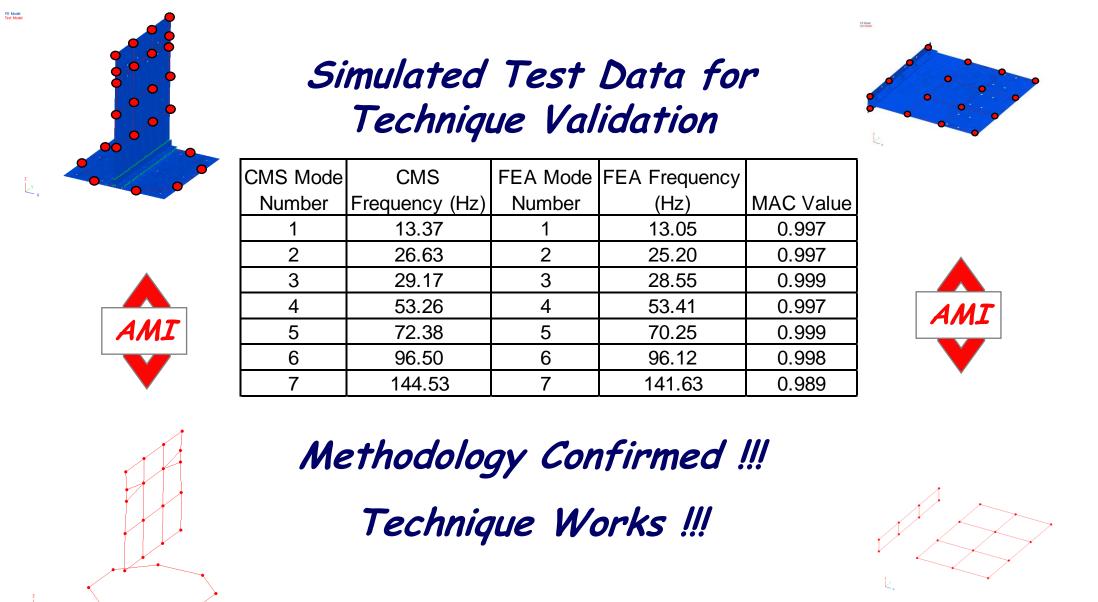
Utilizing and extending real time operating data expansion techniques allows for new approaches for prediction of dynamic stress and dynamic strain in rotating and non-rotating systems



These efforts are currently under research investigations

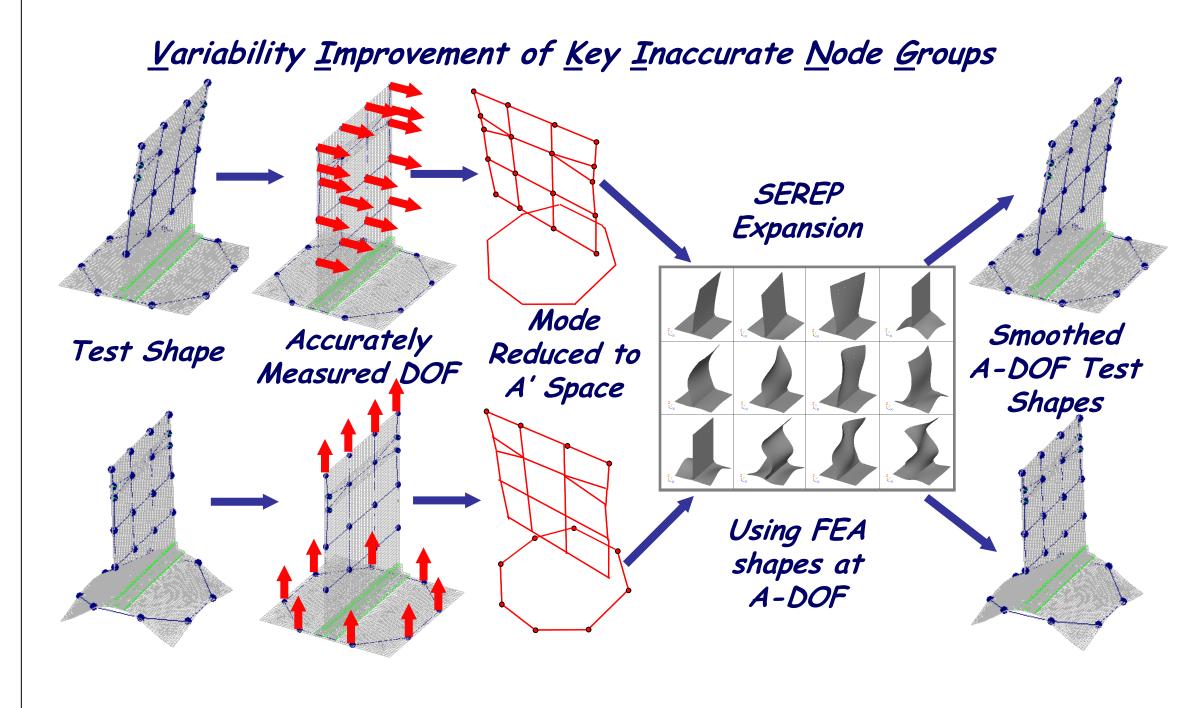
Craig Bampton Component Response - CBCR
Test Verified, Reduced Order Component Models used to form
Craig Bampton Component Mode Synthesis Models - Individual
components are reduced and then updated using a direct
updating technique prior to being used for CB-CMS approach





ALL MEASURED DATA WILL SUFFER FROM IMPURITIES

The VIKING Technique enables necessary data cleansing approaches to improve data for all processing performed. It is imperative that this be done for data collected. Early studies show that this is a major breakthrough for processing measured data and overcomes problems that have plagued these approaches for decades.



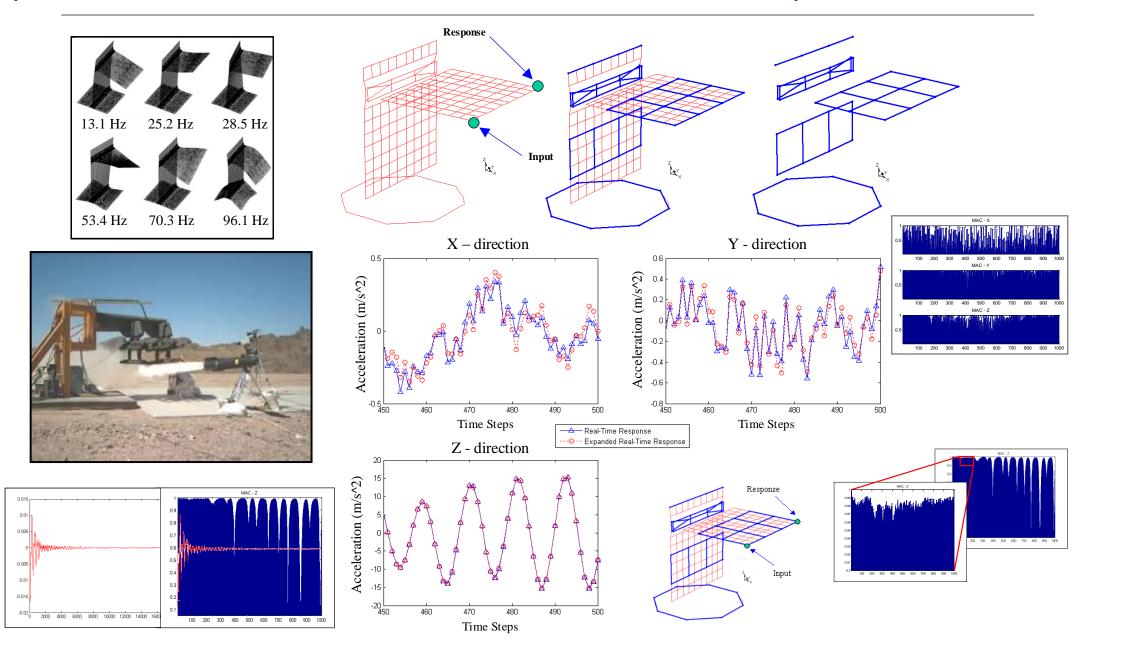
Real Time Operating Data Expansion allows for Improved Visualization

Operating data is often collected at a limited set of points.

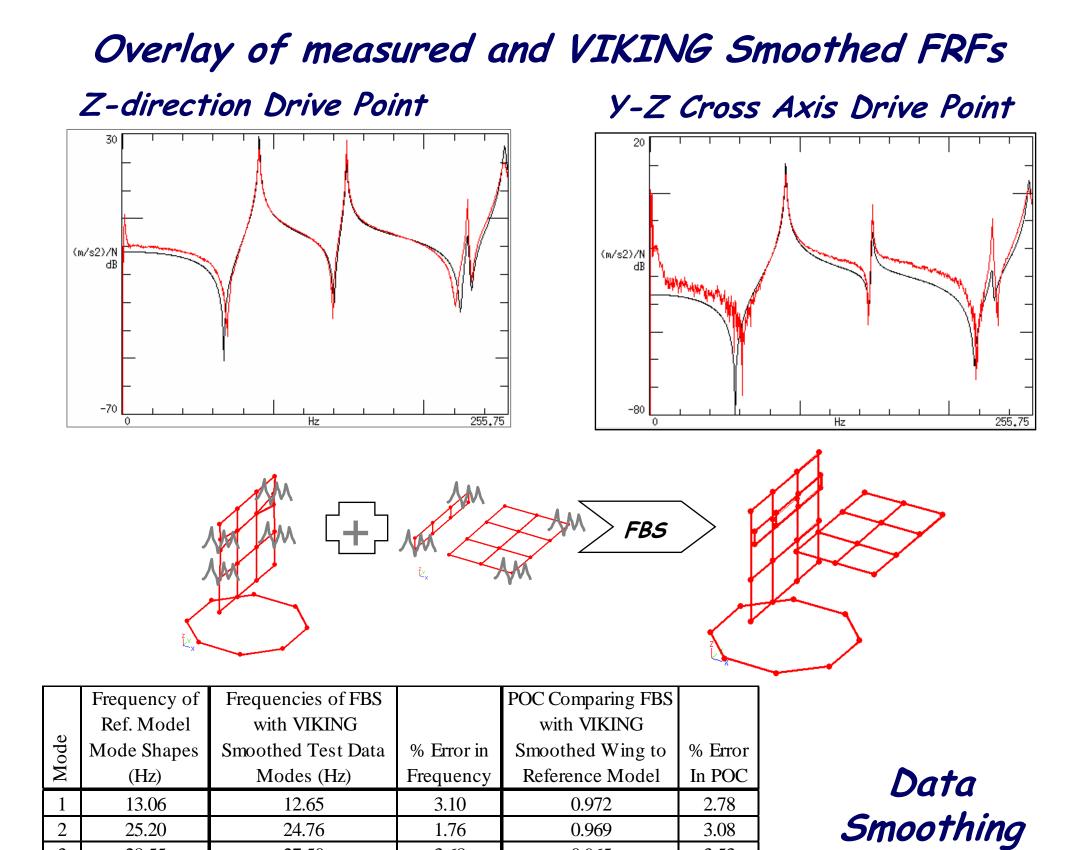
Interpretation of this "strawman" data is often confusing.

Expansion techniques are employed to optimize and visually enhance this important data to allow for better interpretation.

Expansion functions can be developed from experimental modal test results. Another possibility uses the analytical model for expansion and allows for the computation of real time operating dynamic stress and strain which is extremely useful







ricquencies of ribs		TOC Companing PDS		1
with VIKING		with VIKING		
Smoothed Test Data	% Error in	Smoothed Wing to	% Error	
Modes (Hz)	Frequency	Reference Model	In POC	_
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24.76	1.76	0.969	3.08	Smc
27.50	3.68	0.965	3.53	7
52.90	0.95	0.985	1.52	i eci
69.72	0.76	0.988	1.17	AAi
95.10	1.06	0.994	0.58	/ / ///
140.80	0.59	0.995	0.55	Typic
185.42	0.06	0.995	0.46	, , , ,
227.82	4.23	1.038	3.80	Conta
234.48	1.39	1.018	1.77	
e % Error:	1.76		1.92	
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A	A		1	13
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	with VIKING Smoothed Test Data Modes (Hz) 12.65 24.76 27.50 52.90 69.72 95.10 140.80 185.42 227.82 234.48	with VIKING% Error inSmoothed Test Data% Error inModes (Hz)Frequency12.653.1024.761.7627.503.6852.900.9569.720.7695.101.06140.800.59185.420.06227.824.23234.481.39	with VIKING Smoothed Test Data Modes (Hz)% Error in FrequencySmoothed Wing to Reference Model12.653.100.97224.761.760.96927.503.680.96552.900.950.98569.720.760.98895.101.060.994140.800.590.995185.420.060.995227.824.231.038234.481.391.018	with VIKING with VIKING with VIKING % Error in Reference Model % Error In In POC 12.65 3.10 0.972 2.78 24.76 1.76 0.969 3.08 27.50 3.68 0.965 3.53 52.90 0.95 0.985 1.52 69.72 0.76 0.988 1.17 95.10 1.06 0.994 0.58 140.80 0.59 0.995 0.46 227.82 4.23 1.038 3.80 234.48 1.39 1.018 1.77

Techniques
Mitigate
Typical Data
Contamination

