
REFERENCES
for
Modal Analysis
And
Structural Dynamics

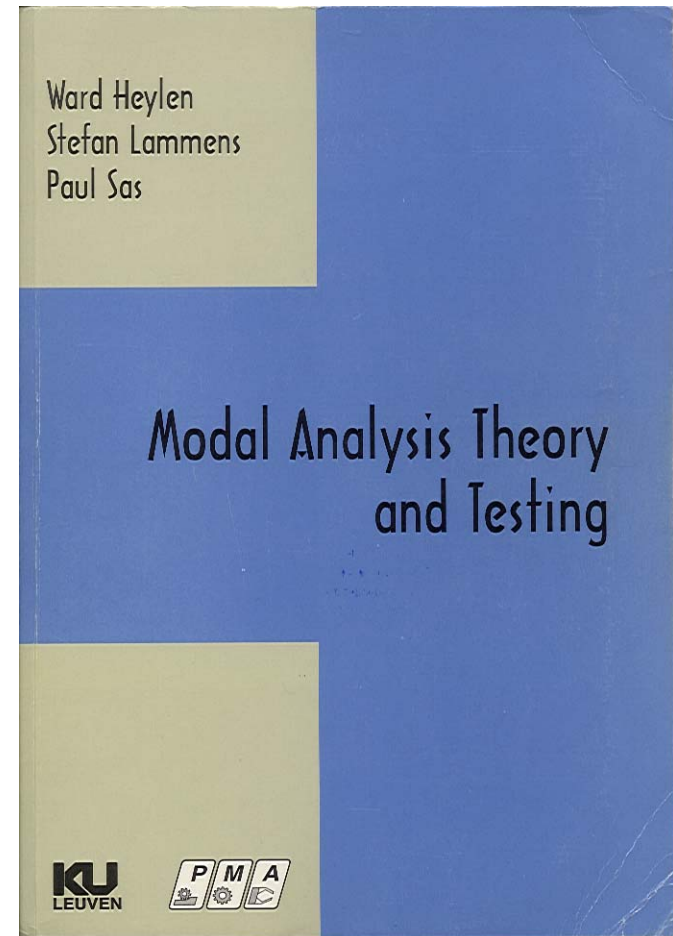


Modal Analysis - Heylen

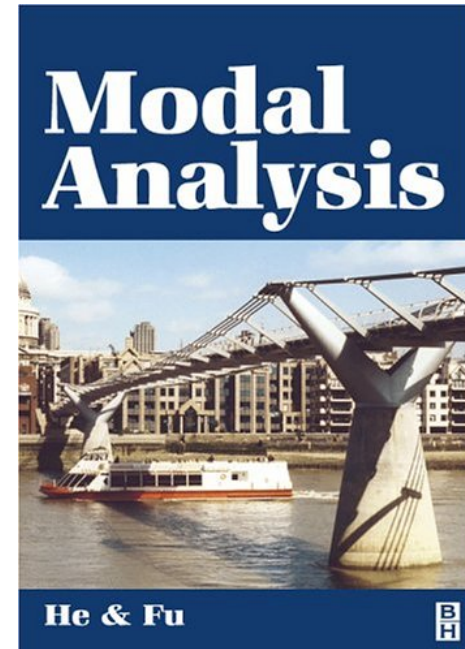
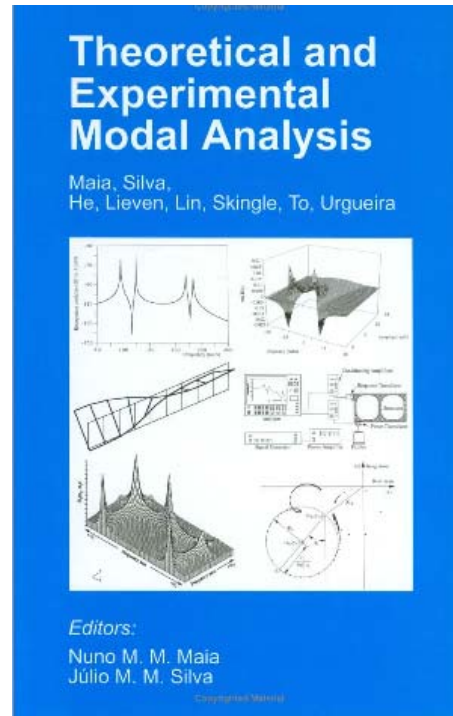
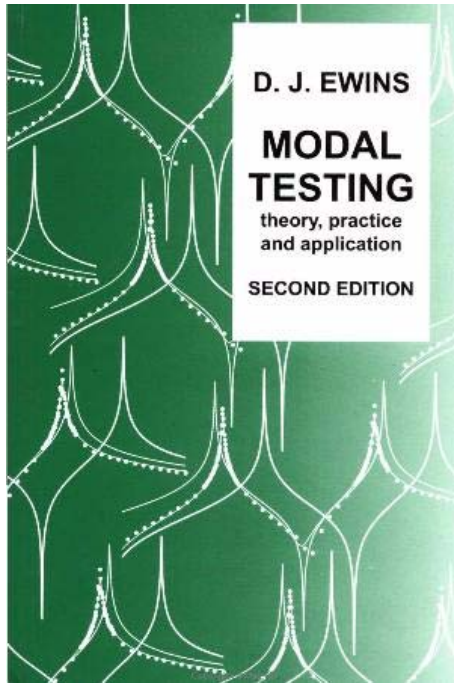
One of the best practical treatments of experimental modal analysis

*Available from SEM
www.sem.org*

This book gives an overview of the experimental approach to modal analysis. The book contains two parts which complement each other: Part A appeals to the more theoretical engineer, or to those who have some practical experience with modal analysis and want to know more about the theoretical background. It covers the basic theory of analytical and experimental modal analysis. Part B covers more practical aspects of experimental modal analysis: instrumentation, calibration and test set-up, excitation, parameter estimation in practice, error detection, prevention and reduction.



Modal Analysis - other possibilities

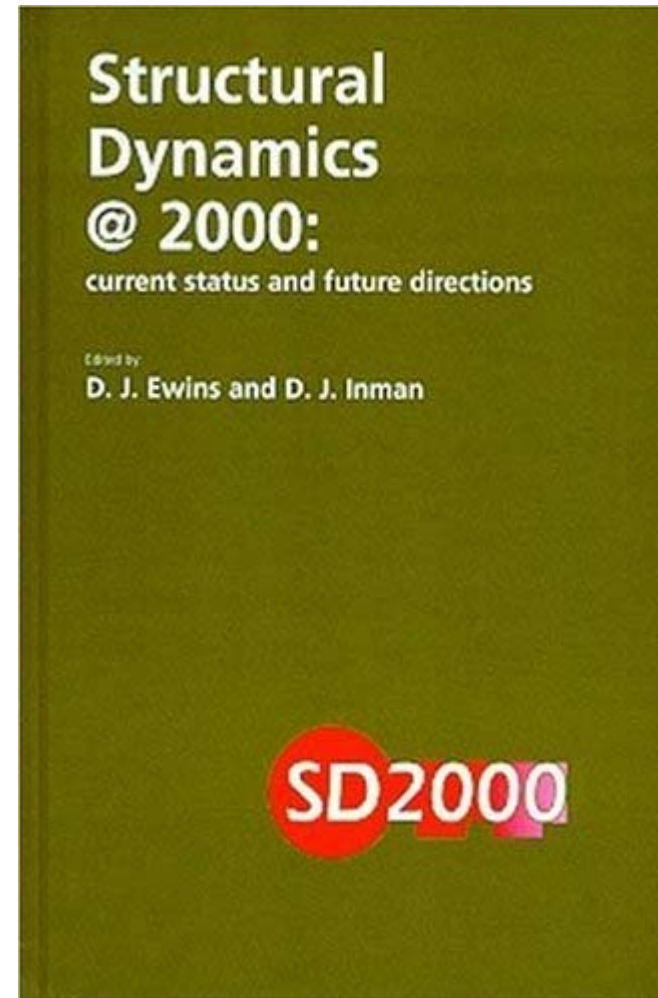


Structural Dynamics@2000

Current Status and Future Directions

*Available from SEM
www.sem.org*

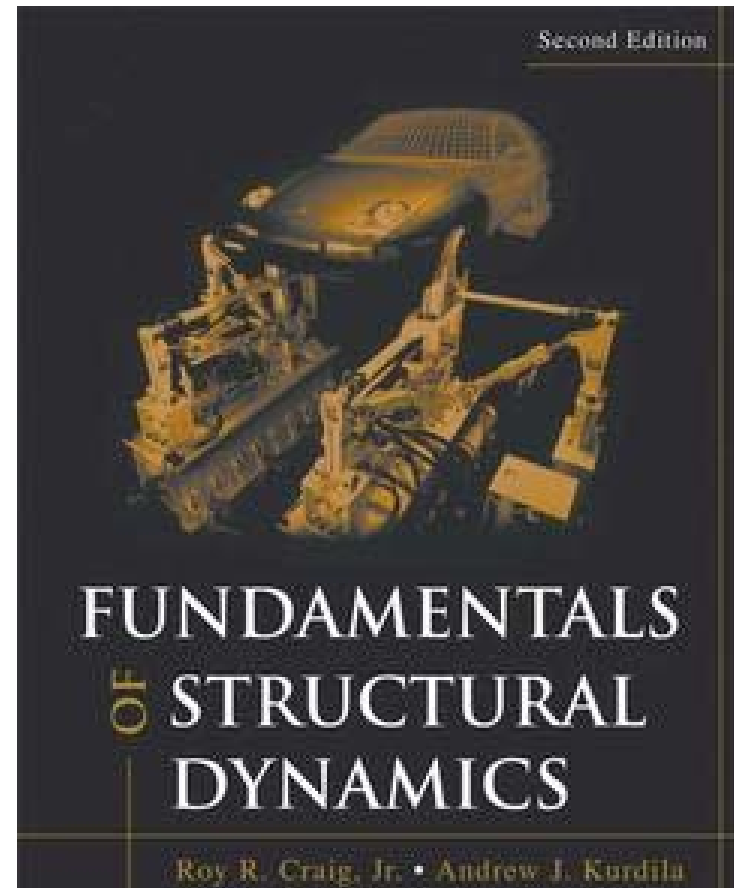
In April of 1999, a group of some 40 structural dynamicists assembled at Los Alamos for a week long debate on a wide range of issues. This event became known as "SD2000". The objectives were to conduct a review of the subject and to make an assessment of where we are, where we need to be and how to get there. This book is a summary of the issues at SD2000 and to provide a guide to current and future practitioners of the subject and it's applications areas.



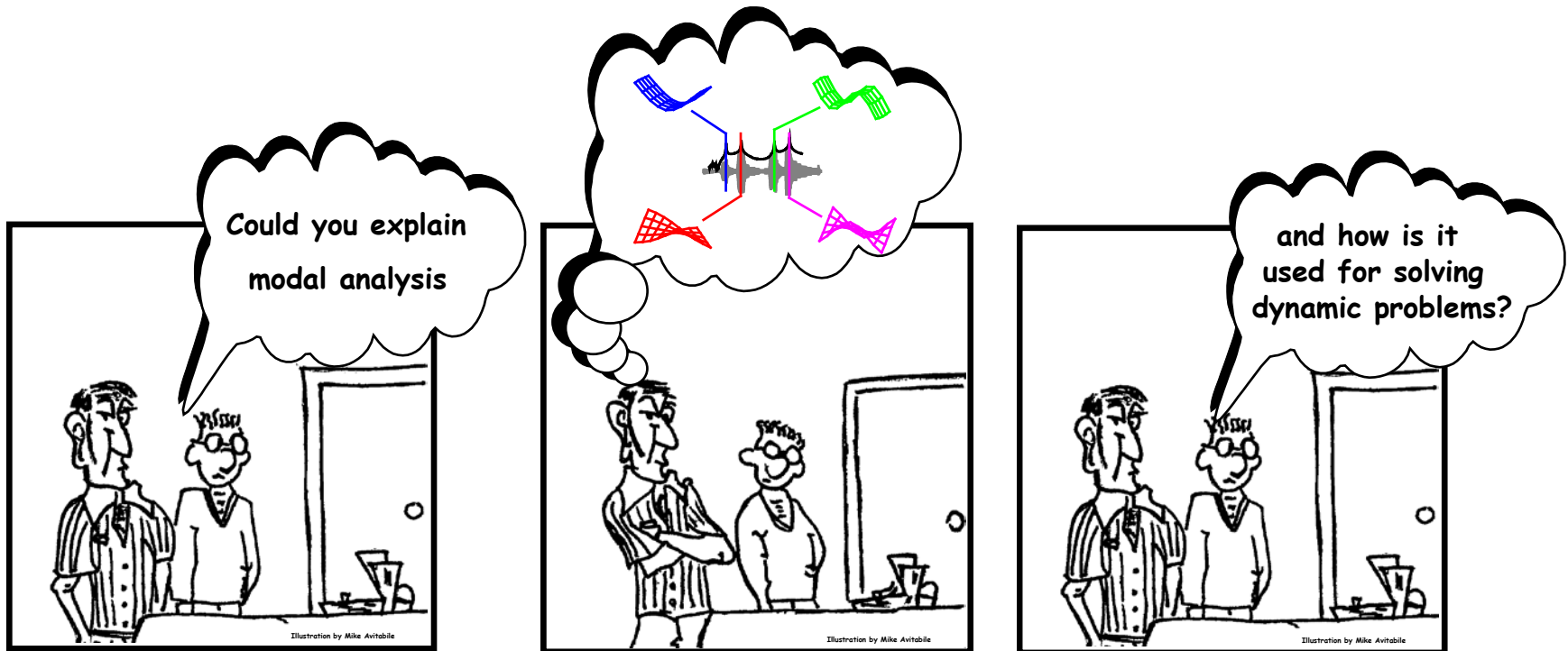
Structural Dynamics - Craig

Excellent text on a wide variety of structural dynamics topics

Structural dynamics is an area that covers experimental, analytical, and computational methods for determining the response of structures to dynamic environments. Structural dynamics covers the theory of engineering vibration, with an emphasis on how to obtain models of real structures by finite-element-based computational techniques. It also emphasizes topics like mode superposition and frequency response, topics that play a significant role in experimental modal analysis. SD is closely related to "mechanical vibrations" textbooks with titles like Vibrations, Engineering Vibrations, and civil engineering type "structural dynamics" textbooks.



MODAL SPACE - In Our Own Little World

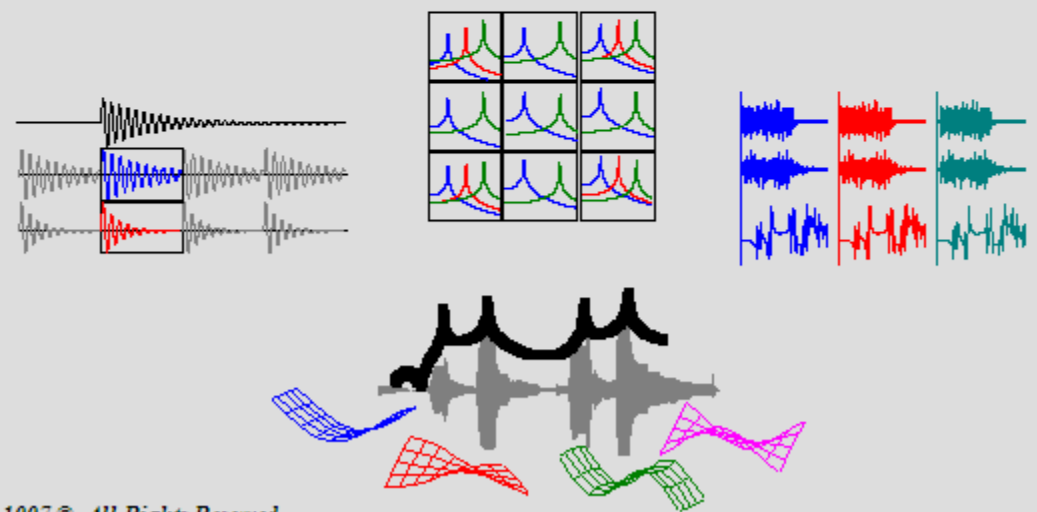


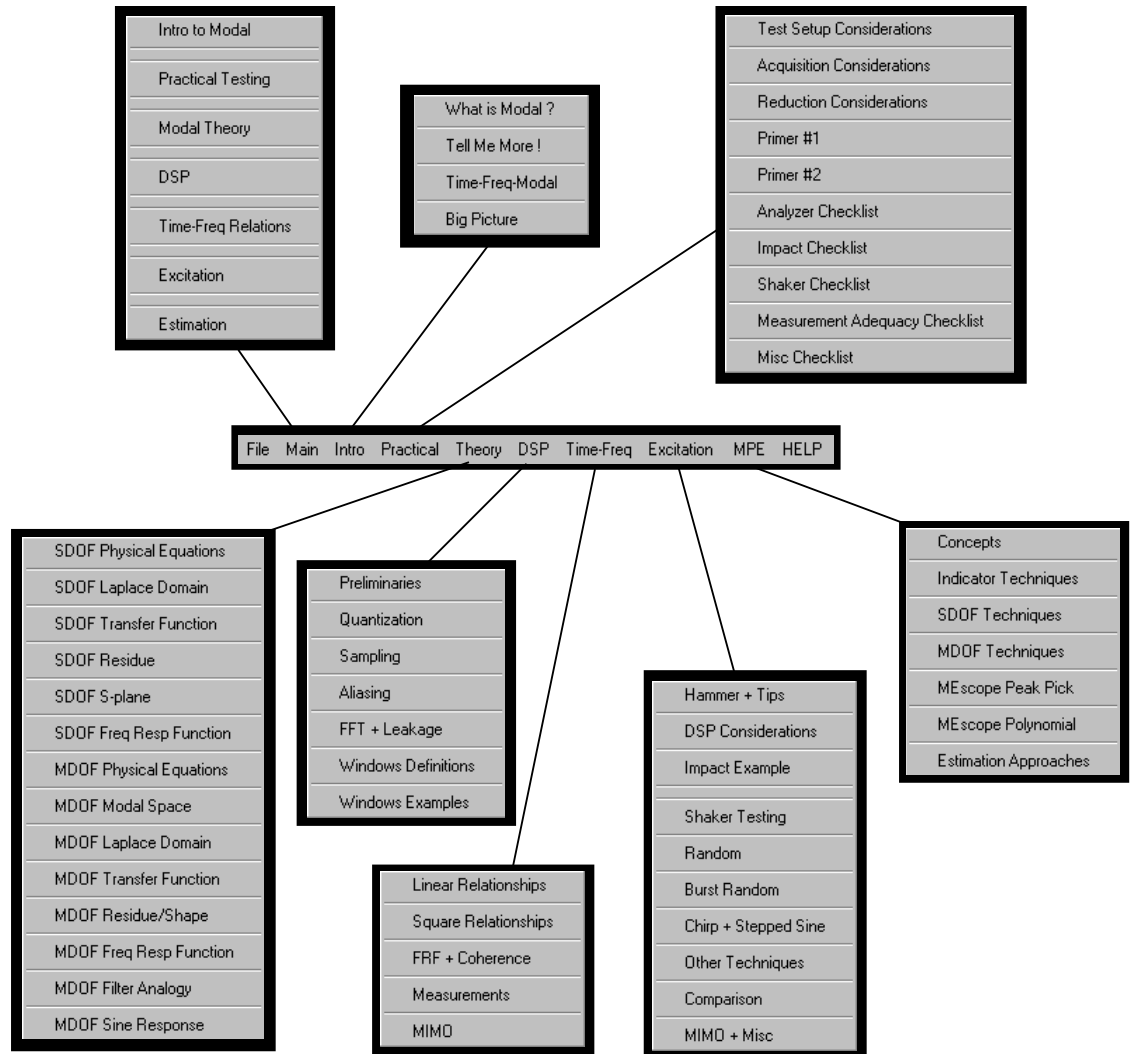
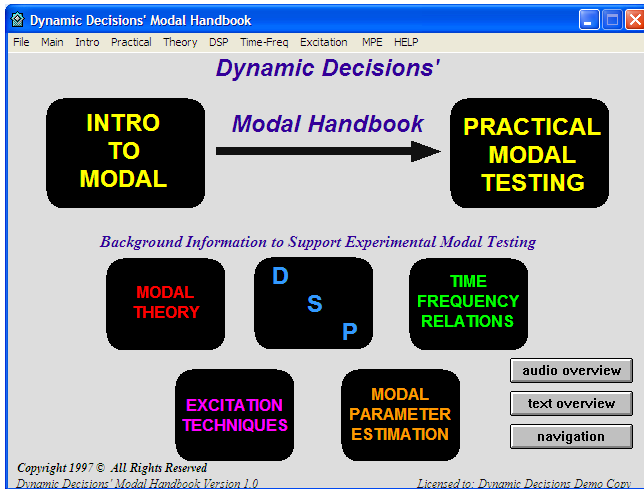
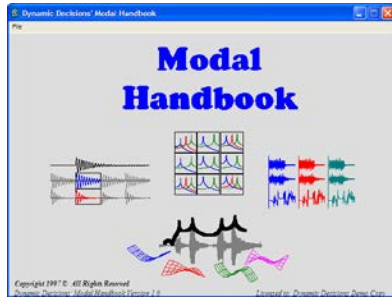
<http://sdasl.uml.edu/umlSPACE/mspace.html>



*Series of articles on various aspects of modal analysis
17 continuous years of publication*

Modal Handbook





Modal Handbook for CADA-X Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Intro to Modal Page 7 First Prev Next Last
 What is Modal? Find Main

Audio/Animate Mode 1 Audio/Animate Mode 3
 Audio/Animate Mode 2 Audio/Animate Mode 4

Modal Handbook for CADA-X Users - Version 1.6X Copyright 1997 © All Rights Reserved

Modal Handbook for STAR Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Practical Modal Testing Page 11 First Prev Next Last
 Primer#2 Audio Text Find Main

Drive Point FRF at the Tip of the Beam

$$h_y(j\omega) = \frac{a_{y1}}{(j\omega - p_1)} + \frac{a_{y2}}{(j\omega - p_2)} + \frac{a_{y3}}{(j\omega - p_3)}$$

Mode Shapes Residues

TEXT VERSION OF AUDIO

So just to re-iterate, we can look at a particular measurement - in this case a drive point measurement - and we know that the frequency response function can be written in terms of residues...

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Modal Handbook for ME'scope Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Modal Parameter Estimation Page 8 First Prev Next Last
 ME'scope Polynomial Techniques Audio Text Find Main

ME'scope Polynomial Technique

Mod	Freq (Hz)	Damp (%)	Magn
1	340.014	592.1E-3	0.000
2	422.988	349.5E-3	0.000
3	752.529	377.4E-3	0.000
4	813.785	338.3E-3	0.000
5	978.218	231.4E-3	0.000

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Modal Handbook for CADA-X Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Excitation Techniques - Impact Page 6 First Prev Next Last
 Hammer & Tips Audio Text Find Main

Comparison of Different Hammer Tips

Click each of the 4 different hammer tips shown

TEXT VERSION OF AUDIO

Now we can look at four different impact tips and look at their corresponding frequency ranges that are excited. In general we can see that as the force pulse in the time domain get shorter and shorter we tend to excite under and wider frequency ranges...

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Modal Handbook for STAR Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Excitation Techniques - Shaker Page 4 First Prev Next Last
 Comparison Audio Text Find Main

Random with Hanning Window vs. Burst Random

COH

FRF

RANDOM & HANNING BURST RANDOM

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Modal Handbook for ME'scope Users

File Main Intro Practical Theory DSP Time-Freq Excitation MPE HELP

Modal Parameter Estimation Page 7 First Prev Next Last
 Concepts Audio Text Find Main

Concepts in Estimating Parameters

HOW MANY DATA POINTS ???

RESIDUAL EFFECTS

HOW MANY MODES ???

$$[H(s)] = \sum_{\text{terms}} \frac{[A_k]}{(s - s_k)} + \frac{[A_k^*]}{(s - s_k^*)}$$

Find

Word/Phrase: "order of the model" 100%

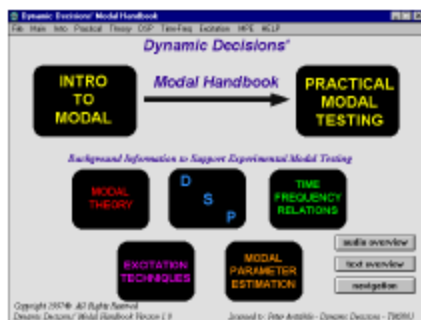
Page: Concepts in Estimating Parameters

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MODAL HANDBOOK

Multimedia Computer Based Training and Reference Material

Simple interface
Easy to understand explanations



Audio and text on every page

Search utility to find info

Analyzer setup info, measurement checklists and more



Customized versions available for many modal packages

Demo Disks available upon request

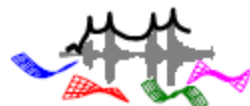


STAR
CADA-PC
ME'scope
CADA-X
others available soon!

Dynamic Decisions, Inc.

Amherst, NH 03031
603-5-123-123

Modal Handbook



This multimedia format presentation starts with some very simple overviews of what modal analysis is all about followed by some very practical information regarding modal testing such as

- analyzer setups
- measurement checklists
- impact testing checklists
- shaker testing checklists
- measurement adequacy pointers
- curvfitting guidelines and tips
- test setup considerations

These are the main items addressed for practical testing considerations. In addition to this set of guidelines, the background information to support modal testing is also available.

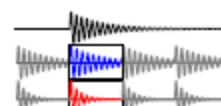
Experimental modal analysis software and data acquisition hardware have been available for several decades now. Several theoretical textbooks can be found which address some of the practical issues and a variety of seminars are available, all of which help the novice and even seasoned modal practitioner understand the implications of modal theory as it applies to data acquisition of fit data and extraction of modal parameters to develop a modal model.

However, even today a good modal test/analysis reference guide does not exist; pieces of information are scattered in a variety of different sources which often are difficult to find - *want new!*

A new multimedia CD format package now exists -
The Modal Handbook



This easy to use multimedia package brings all the important issues of experimental modal testing to a very simple level of explanation and understanding. A very simple user interface allows the modal test engineer/technician to quickly access information pertinent to running modal tests. By using either pull down menus, hot spots or buttons on the screen, navigation to pertinent information is a mouse click away. Very simple, easy to understand pictures are used to explain complex theoretical concepts to take away the mystery of modal analysis and allow just about anyone to understand modal analysis and testing/extraction procedures. There are no detailed, lengthy theoretical developments to cloud or confuse the issues - just simple straightforward explanations.



The material in this multimedia format presentation is intended to augment the modal test engineer/technician's knowledge and understanding in performing routine modal tests. Practical issues are addressed rather than developing detailed theoretical equations. The main goal is to quickly answer often asked questions concerning routine tasks raised by the majority of occasional modal testers such as

- Which window should I use?
- Which impact tip is best?
- What shaker excitation should I use?
- How many modes do I need to fit?

to name just a few typical questions.

These types of questions are addressed in this multimedia format presentation and provide great insight into understanding modal analysis as a tool to solve problems.

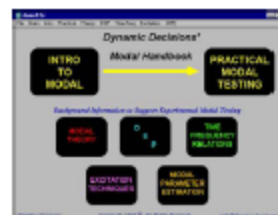


This multimedia format presentation was developed by Peter Avitabile, President of Dynamic Decisions. His extensive knowledge and experience is packaged here in a very useful, yet easy to use format.

This multimedia format material is designed for use on Windows 3.x, 95 and NT systems. Demo disks are available.

Customized versions of the Modal Handbook are available for most modal analysis software packages (Spectral Dynamics' STAR, LMS CADA-X, Vibrent Technology's ME'scope and LMS CADA-PC)

For more info, write or e-mail:
Dynamic Decisions, Inc.
3 Appleton Way
Amherst, NH 03031

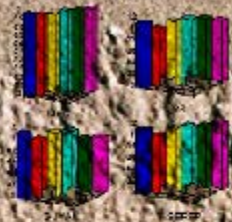


All the important items regarding modal analysis is contained in this presentation

- review of pertinent modal theory regarding adof and mdoof systems
- DSP with sampling, quantization, aliasing, leakage and windows
- Time-Frequency relationships including FRF and Coherence
- Excitation using impact and shakers with information on hammer tip selection, window considerations and different shaker excitation types
- modal parameter estimation techniques explaining the need for different types of curvfitters and when to use which technique.

Dynamic Decisions

RAC AND ORTHOGONALITY GROUPS



Dynamic

DOF CORRELATION

CBMAC CORTHCG

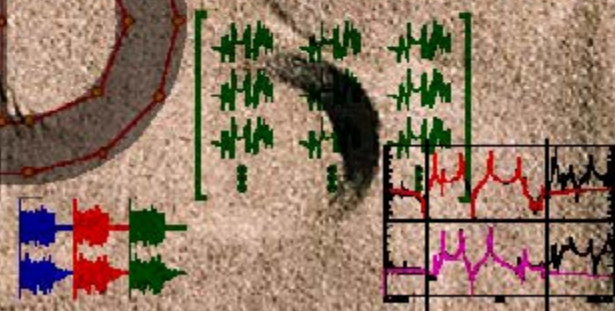
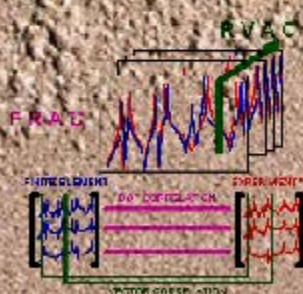


FEM

TEST



Decisions



making complex concepts ... simple !!!