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## **Advanced Modal Seminar – Administrative Information** **Validation and Updating of FE Models for Structural Analysis** **Schedule: November 8<sup>th</sup> – 10<sup>th</sup>, 2010**

**Background Discussion & Abstract:** Navcon Engineering has been presenting modal testing seminars since 1990. During the “*Hands-On Modal Testing & Analysis Course*” we discuss modal theory and analysis, but really focus on the practical aspects of modal testing including test planning, data acquisition, data reduction, parameter estimation and results presentation. Over the past few years, many FE Analysts have attended our modal trainings. In addition, many more test engineers tell us that they are being tasked with Pretest Analysis and Model Correlation. We have had numerous requests to put together an “Advanced Modal Course” tying the test with the analysis.

During the **Advanced Modal Course**, the participants will not only learn the basic principles of test-analysis correlation and finite element model updating, but will also get hands-on experience using specialized software (**FEMtools**). All aspects of a FE model validation process will be reviewed including the import and correlation of FEA and test models, the correlation of FEA/test data and results, the selection of model updating parameters, the definition of realistic targets, the computation of sensitivity coefficients, running of updating loops and post processing of results. Complementary technologies and applications such as probabilistic analysis, pretest planning, structural modifications, force identification and material characterization will also be discussed and applied.

Attendees are encouraged to bring a laptop computer with them for use during the laboratory exercises. We will load a fully functional copy of **FEMtools** on the laptops which will operate for 30 days. The software can be used to repeat the laboratory exercises after the class or for the analysis of the attendees' FEA/test data.

**Intended Audience:** Engineers involved with CAE, structural dynamics analysis, modal testing, analysis quality assurance, noise and vibration troubleshooting. The methods shown can be applied to a wide range of industrial applications.

**Course Objective:** By the end of the course, you will gain understanding of the principles of FE model validation and updating and how they can be applied in practice.

**Presenters:** The course will be presented by experienced engineers who have consulted, developed software and presented courses for companies worldwide in the field of modal testing, vibration control, structural dynamics, and finite element model updating.

**Registration:** Advanced registration is required. You can register online or complete and return the enclosed registration form. The registration form can be downloaded from our web site (<http://www.navcon.com/AdvancedModal.htm>). Note that the number of participants is limited and early registration is recommended.

**Course Fee:** **\$1850** per attendee. The course fee includes participation, course notes, lunches and refreshments. A full refund will be made for all cancellations received 30 days before the start of the course. No refunds will be granted after the 30 day deadline. Substitute attendees will be accepted at any time. In the event that we have to cancel the course, the course fee will be refunded in full, but we disclaim any further liability.

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## **Advanced Modal Seminar – Course Outline**

### **Validation and Updating of FE Models for Structural Analysis**

**Day 1 : 8:30 am – 5:30 pm**

#### **Introduction**

- Needs, motivation and strategies for model validation
- Discussion of processes and data flow
- Managing model validation projects

#### **Database Management and Finite Element Analysis**

- Importing standard FEA and test data (model, shapes, FRF)
- Using finite element analysis solvers (mass analysis, static analysis, modes analysis, FRF synthesis, forced response analysis) and piloting standard FEA software.
- Examining the analytical and experimental database. Checking database integrity.
- Database operations: coordinate system transformations, defining sets, mode shape normalization,...

#### **Correlation Analysis**

- Mapping FE and test models (geometry correlation)
- Expansion and truncation of mode shapes
- Global and local shape correlation
- Reduction of system matrices (Guyan, IRS, Craig-Bampton)
- Mode shape orthogonality checking
- FRF correlation

#### **Pretest Analysis**

- Overview of pretest analysis procedures
- Selection of target modes
- Selection of sensor locations; manual and automated procedures
- Creation of test models

**Day 2 : 8:30 am – 5:30 pm**

#### **Sensitivity Analysis and Model Updating**

- Selection of parameters and responses
- Sensitivity analysis

- Using mass information in model updating
- Model updating using static test data
- Modal-based model updating
- FRF-based model updating
- Parameter relations
- Multi-model updating
- Superelement-based model updating
- Model updating using DOE/RSM

#### **Probabilistic Model Validation and Updating**

- Overview and theoretical background
- Data preparation and postprocessing
- Probabilistic model updating methods

**Day 3 : 8:30 am – 5:30 pm**

#### **Applications of Model Updating**

- Material identification
- Equivalent property identification
- Structural damage identification

#### **Structural Dynamics Modification**

- Overview and theoretical backgrounds
- Definition of modification elements
- Parameter slider and range controls
- Applications of SDM in model updating

#### **Force Identification and Updating**

- Overview and theoretical background
- Data preparation
- Nodal and pressure load identification

#### **Script Development**

- Database management
- Analysis integration and process automation
- Mesh manipulation (refinement, coarsening, element type conversion, transformation,...)

#### **Review and Closure**

- Review and summary
- Ongoing research & development
- Q&A

**Advanced Modal Seminar – Course Registration Form  
Validation and Updating of FE Models for Structural Analysis**

<b>Seminar</b>	November 8-10, 2010 <input type="checkbox"/>
<b>Name(s)</b>	.....
<b>Company</b>	.....
<b>Address</b>	.....
<b>City, State, Zip</b>	.....
<b>E-Mail</b>	.....
<b>Phone</b>	..... <b>Fax</b> .....
<b>Date</b>	..... <b>Signature</b> .....
<b>Payment</b>	<b>P.O. No.</b> ..... <b>Company Check</b> <input type="checkbox"/> <b>Payment: US \$</b> _____ <b>Bank Transfer</b> <input type="checkbox"/> <b>Credit Card: Visa</b> <input type="checkbox"/> <b>MasterCard</b> <input type="checkbox"/> Credit Card #: _____ Expiration Date: ____ / ____ Name on Credit Card: _____ Billing Address: _____ Billing Zip Code: _____ Card Verification Value CVV #: _____ (3 digits on the back)

**Course Fee: \$1850** per attendee. We accept company purchase orders with terms of Net 15 days, company checks, money orders and bank transfers (please contact us for bank details). The course fee includes participation, course notes, lunches and refreshments. A full refund will be made for all cancellations received 30 days before the start of the course. No refunds will be granted after the 30 day deadline. Substitute attendees will be accepted at any time. In the event that we have to cancel the course, the course fee will be refunded in full, but we disclaim any further liability.

For administrative & technical questions phone +714-441-3488.

**To Register, complete and Fax this form to +714-441-3487.**