

# Advanced Machinery Dynamics Course

Florence, Italy • November 9-13, 2009

## About the course

This course provides students the training needed to extend their knowledge of machinery diagnostic techniques and rotor dynamics as applied to rotating machinery. In particular, they will learn the use of synchronous and non-synchronous perturbation testing to evaluate complex Dynamic Stiffness in rotor/bearing/ seal systems, including its modal parameters, and see how to bring analytical model response predictions in closer agreement with actual machine data. The class also examines how rotor torsional modes are coupled with lateral modes, and how that information may be used for early detection of shaft crack. Students will learn how to model machinery operation and malfunctions in fundamental terms, preparing them to better identify and understand machinery problems in the field. The hands-on workshop uses standard vibration diagnostic tools on machine-simulating rotor kits. This reinforces learning by allowing participants to put theory into practice. Case histories that highlight the vibration documentation, analysis, and machine malfunction corrective techniques will be presented throughout the course.

## Who should attend?

- Engineers desiring to advance their machinery vibration diagnostics skills.
- Engineers involved in the design, acceptance testing, and maintenance of rotating machinery.
- Post-graduate engineering students.
- Academic researchers and professors involved in rotor dynamics.

## About Florence, Italy

Florence, the spectacular capital of the region of Tuscany, is located on Italy's northwest coast. It is a stunning medieval city divided into two parts by the River Arno that flows from the Apennines through Florence and Pisa and on to the Ligurian Sea. Florence is considered one of the most beautiful cities in the world with its overflow of palaces, churches and museums filled with masterful paintings and sculptures.



Throughout history, Florence has played an important role in the world's culture. Home of classical Italian and of the Italian Renaissance, the city remains an extremely popular international destination for travelers each year.



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## Course agenda

### Monday

- Welcome, Opening Remarks "Future of Rotor Dynamics"
- Introduction to Rotating Machinery Dynamics
- Steady State and Startup/Shutdown Plot Review
- Basic Rotor Modeling
- Fundamental Synchronous Rotor Response
- Synchronous Dynamic Stiffness Testing
- *Workshop*: Synchronous Dynamic Stiffness (including calculation of Synchronous Dynamic Stiffness Components)

### Tuesday

- Rotor-to-Stationary Part Rubbing
- *Case Histories*: (1) Steam Turbine Rub During a Shutdown and (2) Generator Seal Rub
- *Workshops*: (1) Diagnose and Identify Partial Radial Rotor-to-Stator Rubs and (2) Show the Usefulness of Mode ID Probes
- Modeling Rotors
- *Workshop*: Rotor Modeling

### Wednesday

- One Lateral-Mode Rotor Model with Fluid Interaction and Non-Synchronous Excitation
- Understanding Anisotropic Systems, with a discussion on the diagnostic use of Full Spectrum
- Perturbation Testing and Identification of Rotor/Bearing/Seal System Parameters
- Dynamic Stiffness Parameters Using Non-Synchronous Perturbation
- *Workshop*: Identify Dynamic Stiffness Parameters Using Non-Synchronous Perturbation to Help Solve Machinery Problems

### Thursday

- Fluid-Induced Instabilities of Rotors
- *Workshop*: Diagnose and Control Fluid-Induced Instabilities
- *Case History*: Center Seal Instability
- Detection of Cracked Shafts
- *Workshop*: Detection of Cracked Shafts

### Friday Morning

- Understanding Gearbox Problems
- Gearbox Case Histories
- Seminar Summary and Closing Comment

## Registration information

- Registration fee: 3000 EURO (excludes VAT)
- Each participant will receive a comprehensive course manual and book of additional references.
- Registration fee also includes continental breakfast and lunch each day, as well as one group dinner. All lodging and other related expenses are the responsibility of the participant.

To register: Visit [www.ge-energy.com/training](http://www.ge-energy.com/training), click on "Equipment and Software Training" and follow the links to Bently Nevada Training. You can also call your nearest sales representative to register for course #OCMDS400FL4609 or Dr. Thomas Kafka, our European Training Manager, at:

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