

# COURSE 102: NOISE & VIBRATION ANALYSIS WITH MATLAB®/OCTAVE EXAMPLES

Saturday, January 28, 2012

## Course Objective

This course gives an overview of signal analysis methods used for noise and vibration analysis and structural dynamics. It is recommended for anyone who is performing measurements and/or analysis of noise and/or vibration signals, whether by a commercial measurement system or by MATLAB. Time domain as well as frequency domain analysis is included in the course. To aid the learning process, MATLAB/Octave is used frequently in the course, which also allows course participants to continue learning after the course. The MATLAB software has become a standard in engineering education and offers a very attractive platform for the student's understanding of mathematics, and has proven to be a very efficient tool for noise and vibration education. In industry, MATLAB is increasingly used for measurement as well as for analysis of noise and vibration signals. Octave, an open-source software, is largely MATLAB compatible, and the examples given in this course are ensured to work also in this free, open software, which can be an alternative to MATLAB in some cases.

## Course Outline

### MATLAB Introduction

For the novice user of MATLAB, we start by giving a quick overview of the software architecture and describe why MATLAB is particularly suited for noise and vibration analysis.

### Data Acquisition and Import

Before any NVH analysis can be done, data needs to be taken into MATLAB. So, in this part, we show how to use MATLAB Data Acquisition toolbox and/or how to import measured data into MATLAB.

### Time Data Analysis

Before data are further analyzed, sometimes basic time data processing may be used, such as filtering, integration or differentiation etc. In this section we present some state-of-the-art tools for these tasks.

### Mechanical System Simulations

Being able to simulate known mechanical models is essential in method development as well as in education. Therefore we give a thorough description of how the MATLAB platform can be used to simulate known mechanical models.

### Spectrum Analysis

Experimental spectrum estimation is a common and important task in vibration analysis. In this part, we give an overview of how scaled spectra (FFT based as well as 1/1 and 1/n octaves) can be implemented and used.

### FRF Estimation

Estimating good frequency response functions is another very important application, particularly in modal analysis. We therefore give a thorough presentation of different ways of estimating FRFs, explaining advantages and disadvantages.

### Experimental Modal Analysis

In the last session, we cover experimental modal analysis in MATLAB. Examples are given of simple SDOF methods as well as more advanced MDOF methods for curve fitting data.

## Instructor

### Prof. Anders Brandt, University of Southern Denmark



After over twenty years industrial experience as a consultant and educator in applications of signal analysis in acoustics, experimental structural dynamics and mechanical wave propagation in structures, Brandt recently went back to academia at the University of Southern Denmark. Here, he pursues his research interests in applied signal analysis and operational modal analysis. He is the author of "Noise and Vibration Analysis – Signal Analysis and Measurement Procedures,"

published by Wiley 2011. Brandt is a devoted and appreciated teacher and lecturer and has led over 200 short-courses for industry around the world, on topics such as data acquisition, vibration analysis, system identification, and structural dynamics.

## Course Material

Copies of course slides and the open source ABRVIBE toolbox for MATLAB will be made available to all participants.

## Course Fee

The *regular* course fee for *Noise & Vibration Analysis with Matlab®/Octave Examples* is \$350, and the *student* course fee is \$175. Course fee includes lunch, course handout material, and refreshment breaks. Lodging and additional food or materials are not included.

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Attendees should bring their own laptop computers with Matlab® or Octave pre-installed.  
There will be no computers made available.

