

# Course 101: Teaching, Learning & Performing Vibration Analysis – Using the Free ABRAVIBE MATLAB Toolbox

Sunday, February 11, 2018 | 9:00 a.m.–5:00 p.m.

## Course Objective

This course is designed for teachers, students and practicing engineers alike. The course demonstrates how the free, open ABRAVIBE toolbox can be used for teaching, learning, and applying vibration analysis. It gives in-depth descriptions of typical methods used for noise and vibration analysis, modal analysis, and order tracking. The ABRAVIBE toolbox and website includes powerful tools including time domain filtering, integration and differentiation etc., spectrum analysis tools, and very powerful simulation tools for illustration and simulation of mechanical systems. This allows teachers to design good and informative examples, students to learn by applying and looking through the provided tools, and practicing engineers get a powerful tool for vibration analysis.

## Course Content

### 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 imported 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 Simulation and Data Synthesis

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.

### Analysis of Rotating Machinery

For analysis of vibrations in engines, turbines and other rotating machinery, rpm-dependent frequency analysis is often used. This is also often called order tracking. The abravibe tools for treating tachometer signals, and creating spectrum and order maps etc. are presented here.

### 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.

### Course Fee/Cancellation

The regular fee is \$500 and the student fee is \$250. Course fee includes course handout material and refreshment breaks. Lodging, additional food and other materials are not included. If the course is cancelled for any reason, the Society for Experimental Mechanics' liability is limited to the return of the course fees.

### Instructor(s):

**Anders Brandt**—*University of Southern Denmark*

Anders has thirty years of industrial and academic experience as a consultant, researcher, and teacher in applications of signal analysis in acoustics, experimental structural dynamics and mechanical wave propagation in structures. He is the author of "Noise and Vibration Analysis – Signal Analysis and Experimental Procedures," published by Wiley 2011. He is also the designer of the ABRAVIBE toolbox for teaching and learning vibration analysis, and is maintaining the website abravibe.com with additional resources for teaching, learning, and applying vibration analysis. Anders is a devoted and appreciated teacher and has held over 250 short-courses for industry around the world, on topics such as data acquisition, vibration analysis, and modal analysis, besides 20 years of teaching university courses.

