Advanced Mechanical Vibrations (ME 401)

Spring 2010 Course Projects

Dynamic Systems, Control & Mechatronics Laboratory
Professor M. Baglione

Combined experimental and analytical approach to mechanical vibration issues

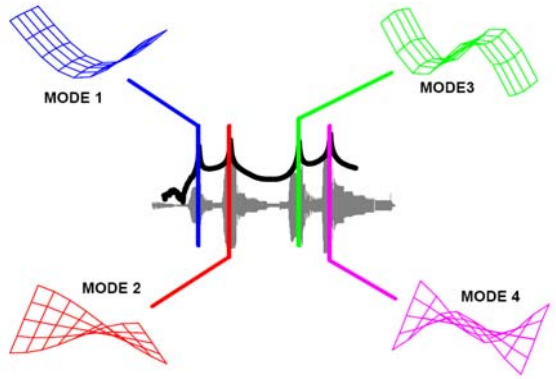
Characterization of the dynamic behavior of a structure in terms of modal parameters

Digital data acquisition and signal processing

Experimental modal analysis procedures and excitation techniques

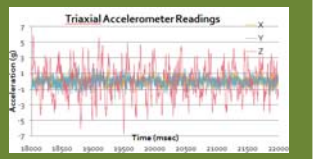
Extraction of modal parameters from measured frequency response functions (FRF)

Hands-on experience with accelerometer, impact hammer and shaker data acquisition



Modal Analysis and Finite Element Analysis of the Stock Chiller

Seyoon Kim and Sherry Liang



This project investigates the vibration of the Cooper Union Stock Chiller. The forced response and dynamic properties are determined by conducting an operating acceleration test and impact hammer testing over the left side panel of the Stock Chiller. The modes are confirmed by results obtained by finite element methods using SolidWorks.

Vibration Analysis of Foot Impact on Tibia for Barefoot versus Shod Runners

Alexander Bronfman and Patrick McQuillan

Articles published in Nature earlier this year by Lieberman et al. indicate that the transient shock waves generated by heel striking with padded modern running shoes may be injurious to the tibia. Modal analysis is performed on a model tibia bone and a test rig is designed to compare foot impacts and frequency responses in semi-barefoot and shod runners.

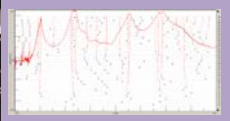
Modal Analysis of a Glass Beverage Bottle

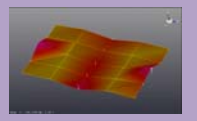
Caroline Lama

Glass beverage bottles are very common and are distributed all around the world. Precautionary packing methods are employed, but breaks are not uncommon. This project investigates the modal characteristics of a glass bottle so that exciting it at its natural frequencies can be avoided if at all possible.

Exploring Closely Spaced Mode Shapes using Shaker Testing and LMS Test.Lab

Samuel Glauber

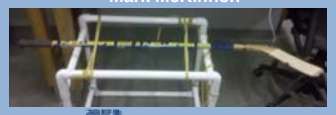


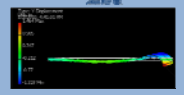


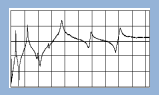
This experiment uses shaker testing to experimentally determine the natural frequencies of a rectangular plate with two closely spaced mode shapes. An ABS plate with an aspect ratio of 2/3 is cut and mounted on the stinger of a modal shaker. A swept sine signal is applied to the shaker and data is processed in LMS Test.Lab to obtain the plate's total frequency response function and animated mode shapes.

Easton Aluminum H16 Junior Hockey Stick Modal Analysis

Mark McKinnon







This experimental modal analysis identifies the excitation frequency of the two-piece hockey stick corresponding to the maximum deflection, determines the position of the "kick point", and explores the existence of a "sweet spot". A finite element model contributed to evidence of the existence of a "sweet spot".

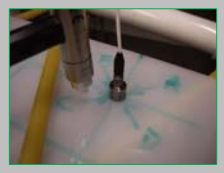
Optimization of an Engine Stand Utilizing Impact Hammer Testing

Dennis Robertson

The engine stand for the 6 hp single cylinder Diesel engine in the Automotive Lab must be designed such that it does not amplify the response and force transmitted at frequencies in the operational range of the engine. This project details process and results of the modal analysis of an engine stand with a specific focus of optimizing the frequency response.

Impact Hammer Testing of a Flat Plate with Closely Spaced Modes

Brian Tovar



This project experimentally calculates a single column of the frequency response matrix for a plate with an aspect ratio such that the natural frequencies of two of the modes are closely spaced. Roving impact hammer testing is performed for 25 points. And the frequency response function for all combinations of measurement point responses and impacts are tabulated.