

ME-5700 Assignment #4 – Fall 2013
Due: October 15, 2013 at 5:00 pm.
INDIVIDUAL WORK ONLY!

The goal of this assignment is to gain an understanding of the estimation of frequency response functions.

Estimating Gain and Phase of an instrument

1. Using the oscilloscope and sine waves generated from a signal generator, determine the GAIN and PHASE characteristics of the amplifier/speaker/microphone combination used in Assignment 2 at frequencies of 50 Hz, and from 1 kHz to 20 kHz at 1 kHz increments (i.e. 50, 1k, 2k, 3k, ... 20k). Do this for two tone settings, LOW and HIGH. Set the gain (volume) in the middle. Note: You can measure the Gain and Phase either directly on the oscilloscope using the “Quick Meas” tools.
 - a. Plot the Gain Characteristic (with a log scale on the y-axis) as well as the Phase Characteristic (in degrees) for each test condition (overlay each of the three volume settings on the same plot).
 - b. Sketch the equipment layout carefully and NOTE amplifier settings.
2. For the same amplifier settings as part 1. Use the FRF measurement in Sound and Vibration Assistant to measure the gain and phase of the response of the amplifier/speaker/microphone combination using a random signal. Use appropriate sampling and windowing to obtain the best results possible. Perform 30 averages using *RMS Averaging* and *Linear Weighting*. Also make a Coherence measurement.
3. Discuss any differences between the gain and phase measured using the oscilloscope and that measured using Sound and Vibration Assistant. Include whatever plots are appropriate to justify your statements. Does the coherence plot tell you anything about your measurements?
4. Repeat task #2 with the weighting (tone) set to HIGH. Compare results to those obtained in task #2.
5. Repeat task #2 with just the amplifier, do not use the speaker and microphone. Discuss any differences measured between this FRF and that measured in part #2. Do your best to describe why the differences are present, you should do some research on component specifications to help you in this description.

Matlab

6. Acquire a long enough time history to compute 30 linearly weighted averages of the signals acquired in tasks #2 and #4. From this time domain data compute the FRF using both H1 and H2 and the Coherence. Compare all results with those acquired in tasks #2 and #4. Discuss any differences and ensure that your FRF and Coherence programs are functioning correctly.

Deliverables:

Submit a report using the standard lab report template that describes the work you have completed along with answers to the questions. You **do not need to include all plots** which you generated in the report, only include plots necessary to support your discussion and conclusions. *Please use the grammar and spell checker in your word processing program.*