ASE 375 Laboratory 6: Accelerometers

Week of 18 March 2024

The goals of this laboratory are to:

- Learn how an accelerometer works

- Measure the dynamic response of a built-up wing with a rap test

Lab exercises:

1. Attach the piezoelectric accelerometer (IMI 660) to the tip of the wing (use a small piece of wax). Gently tap the wing and record the output of the accelerometer over five seconds. Use a sampling frequency of 1 kHz. Do this for ten taps so that you can average the measurements.

2. Repeat the above experiment using the MEMS accelerometer (MMA 7361L). In this case, tap the wing at an angle so that you excite both the out-of-plane and in-plane bending vibration. Measure the accelerations in both these directions.

3. Plot the measured accelerations and compare the two sensors. Use the acceleration to calculate the tip displacement as a function of time. Describe the errors inherent in these measurements.

4. For both the piezoelectric accelerometer and the MEMS accelerometer, plot the power spectrum of the measured acceleration using (a) the five seconds of data (b) the last one second of data. Identify the natural frequencies of the wing. What are the differences between the power spectrum of (a) and (b)?

   NOTE: Since you cannot determine exactly when you tapped the wing, averaging the ten taps in the time domain will not yield a correct power spectrum. You must calculate the power spectrum for each tap and then average the ten power spectra.