Objectives:

The characteristics of a mass-spring-damper system were determined through the use of a linear velocity transducer (LVT) that produces a voltage proportional to the velocity of a magnetic core. Next, the properties of a linear variable differential transformer were investigated by calibration through weights and beam deflection. The effects of modulation and filtering were also observed. Experimental frequency response of the system was then determined using Lab View Signal Express.

Theory:

2.3. LVDT Frequency Response

The break frequencies were found by extrapolating a linear fit for the horizontal line for usable bandwidth in the magnitude plot. Then the intersection points with the sloped filtered magnitude lines were found such that the error with the actual curve is about 3 dB. The frequencies at these two points are the break frequencies. See Figure #####



Figure 1: 1st Break Frequency Approximation. The larger time division data was used.



Figure 2: 2nd Break Frequency Approximation. The smaller time division data was used.

The LVDT system follows the following transfer function

From the spec sheet

The transfer function is in standard form, so time constant relationships can be used with the s coefficients in the denominator. is the input impedance, is the output impedance, and is the measuring impedance

Usable bandwidth is between the break frequencies, 308 Hz – 47.5 kHz

The theoretical sensitivity for any frequency within this bandwidth is determined by taking the magnitude of the transfer function for that range.

The sensitivity is defined from the bode plot as 0.0794 (-22 dB). Assuming x=0.1 in, the gain term is defined as follows

The total gain for the transfer function (numerator coefficient) can be found from