

# Integration-Differentiation MATLAB GUI Assignment

The Integration-Differentiation MATLAB GUI should be used for the following exercises, in which the effect of various measurement contaminants on numerical processing will be examined.

The given values for the various parameters will produce results similar to those seen in the Virtual Measurement System assignment. The absolute magnitudes of the signals, noise, etc, are different, however the resulting signals are qualitatively similar.

## DRIFT AND BIAS

The effects of drift and bias on numerical processing will first be examined. Treat the signal as though it were an accelerometer measurement, which would be integrated to obtain velocity and displacement.

1. Add a drift with a slope of 0.15.
2. Integrate the signal once. Then integrate the original signal twice. Observe the results. Why do the bias and drift have this effect on the numerical processing?
3. Add a bias of 0.2. Again, integrate the signal once, then twice, and observe the results.
4. Although this would not be done with an actual accelerometer measurement, differentiate the signal once, then twice. Observe the results. Was the differentiation affected by the bias and drift?

## NOISE

The effects of noise on the numerical processing will now be examined. Now treat the signal as if it is an LVDT displacement measurement, which would be differentiated to obtain velocity and acceleration.

1. Reset the bias and drift to 0.
2. Change the sinusoidal noise amplitude to 0.1, and the sinusoidal noise frequency to 60 Hz. Observe the signal—if you saw this measurement in an actual test, could you tell that it has sinusoidal noise?
3. Differentiate the signal once, then twice. Observe the result. What effect did the noise have on the differentiation?
4. Increase the sinusoidal noise amplitude to 0.08. How obvious is the sinusoidal noise now?
5. Differentiate the signal once, then twice. Observe the results. How could this signal be processed to eliminate the problems with the noise?
6. Although this would not be done with a displacement measurement, integrate the signal once, then twice. How was the numerical integration affected by the noise?