ESE-3014 Lab1-Review Octave and analog signal processing

Theory

GNU Octave is a high-level language, primarily intended for numerical computations. It provides a convenient command line interface for solving linear and nonlinear problems numerically, and for performing other numerical experiments using a language that is mostly compatible with Matlab. It may also be used as a batch-oriented language.

Octave has extensive tools for solving common numerical linear algebra problems, finding the roots of nonlinear equations, integrating ordinary functions, manipulating polynomials, and integrating ordinary differential and differential-algebraic equations. It is easily extensible and customizable via user-defined functions written in Octave's own language, or using dynamically loaded modules written in C++, C, Fortran, or other languages.

Task

1. Create a 5x1 vector of zeros. Create a 2x5 matrix of random numbers.
2. Multiply a column of a matrix with an element of this same matrix.
3. Create a plot of the sin function between 0 and 6π.
4. Simulate an amplitude modulation (AM) system with all input, carrier and output signals. Say the input signal is a cosine wave with amplitude as 2V and frequency as 1000Hz. The carrier signal is also a cosine wave with amplitude as 5V and frequency as 10KHz. The modulation degree is 0.5, and the initial phases of all cosine wave are 0. (Recall Nyquist sampling theorem to avoid distortion i.e. under sampling)
5. Use the signals above, consider a actual vivid simulation mode, and add random noise in output signal. In this simulation, we divide time domain into several duration, and call each duration as frame. The scanning cycle of an oscilloscope is equal to frame period, that means each time we simulate a frame of signal, and the display will be refreshed once. Therefore, we can get a constantly sliding input signal, a carrier signal with phase jitter, and output signal with noise.