

Digital Communications
Homework #4
Due 10/10/2007

1. Show that if $v(t) = \text{Re}\{g(t)e^{j\omega_c t}\}$ then $v(t) = R(t)\cos(\omega_c t + \theta(t))$ and $v(t) = x(t)\cos(\omega_c t) - y(t)\sin(\omega_c t)$. Note that $g(t) = x(t) + jy(t) = R(t)e^{j\theta(t)}$
2. Plot time domain and frequency domain examples of a BASK signal using Matlab. Specifically plot 10 bits of 4bps data stream when the carrier frequency is 50Hz. Repeat for BPSK.
3. Problem 6.2 in the text.
4. Problem 6.4 in the text. For part (b), try plotting the signal for the given values of α in order to determine the delay that would be appropriate provided that we don't want to cut off values greater than 5% of the peak value.
5. Problem 6.8 in the text. You may use the known Fourier relationship between equation (6.19) and (6.17).
6. Problem 6.9 in the text.
7. Problem 6.15 in the text. Note that quaternary PAM uses four levels (i.e., symbols).
8. Problem 6.16 in the text. (use Matlab with the function `eyediagram`.) Also, the bit rate should be $2f_o$ rather than $2B_o$.
9. Derive the power spectral density for Binary Phase Shift Keying.
10. Derive the power spectral density for Binary Amplitude Shift Keying.
11. Suppose that a transmitter modulates a sinusoid by using an in-phase component consisting of a square wave that takes on values of either +1 or -1 and a quadrature component consisting of a square wave that takes on values of either +2 or -2. How is the resulting sinusoid modulated (amplitude, phase or frequency)? How many values can the (amplitude/phase/frequency) assume and what are they?
12. An analog voice signal is to be sampled, quantized and transmitted using BPSK modulation. The original analog signal has a bandwidth of 4kHz. A quantization SNR of 50dB is desired. If the peak to average power ratio is 10dB, what is the second-null-to-null bandwidth of the transmitted signal?