

Answers to homework on OFDM and spread spectrum

1. Create a script in Matlab that is able to
 - a) Display four different orthogonal sine waves in the time plane
 - b) Display the signals in the frequency plane (power spectrum density)
 - c) Show that the signals are pairwise orthogonal by calculating the sum of the inner vector product (dot product, scalar product).

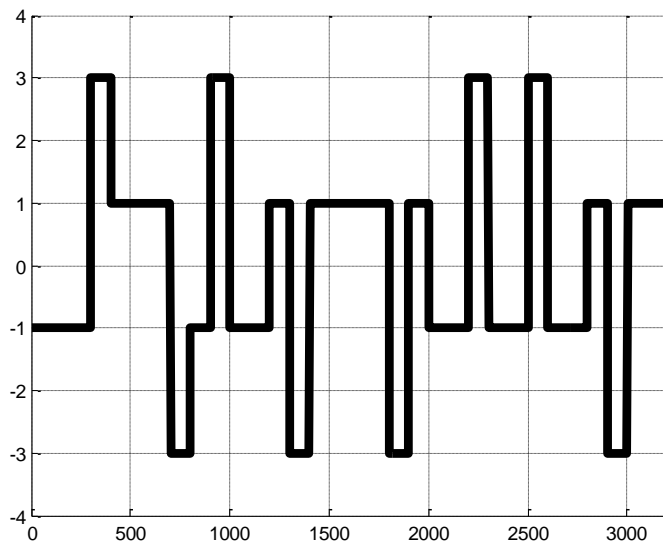
2. You want to jam a wireless connection that is using spread spectrum direct sequence with a spreading code consisting of 6 bits. The transmitted power is 100W and the purpose of jamming is to achieve $\text{SNR}=1$, i.e. 0dB. What power is needed to achieve this?

Ans: With 6 bits the bandwidth will be increased 6 times. The processing gain will be 6 and the power you need is 6 times higher than the signal power, i.e. 600 W.

3. CDMA.

Consider a receiver using a channel with channelization code (spreading code) '1001 0110'. You receive the signal shown in the figure below. Zero (0) is represented as a negative value and each chip has a duration of 100 (time units). What data was sent?

A second uses the spreading code 1100 0011. Decode the data string. A third receiver has spreading code 1010 0101. Decode the data string. Are these codes orthogonal?



Ans: First receiver: 1 0 1 0. Second: 0 1 1 1. Third: 0 0 0 0. The spreading codes are orthogonal.