S72-238 WCDMA systems

Tutorial 2   25.01.2002.

Exercises

1.

Two spreading signals in vector form are $s_1 = [-1\,1\,1-1]$ and $s_2 = [1-1\,1-1]$ with the chip length $\tau_1 = 1$.

a) Calculate the cross correlation function between the spreading sequence $s_1(t)$ and signal $s_{11}(t)$ that is bit sequence $[1\,1]$ spread by $s_1(t)$.

b) Calculate the cross correlation function between the spreading sequence $s_1(t)$ and signal $s_{10}(t)$ that is bit sequence $[-1\,1]$ spread by $s_1(t)$.

c) Calculate the cross correlation function between the spreading sequence $s_1(t)$ and signal $s_{21}(t) = [1\,1]$ spread by $s_2(t)$.

d) Calculate the cross correlation function between the spreading sequence $s_1(t)$ and signal $s_{20}(t) = [-1\,1]$ spread by $s_2(t)$.

2.

The transmitted signal sequence is $a = [0\ 1\ 0\ 1]$. The spreading sequence is
$s_1 = [-1\ 1\ 1-1]$.

Calculate amplitude of the signal and the interference for every bit if the channel response is

Tap amplitude	0.5	0.3	0.2
Delay τ in chips	0	1	2

And Rake receiver is tuned to the first channel tap.

3.

Consider the feedback shift-register shown below with mod 2 calculations.
a) What is the polynomial that the shift register represents?
b) Determine the output of this circuit with the initial shift-register load
$a_0 = 1 \quad a_1 = 0 \quad a_2 = 0$.
c) Determine the output of this circuit with the initial shift register load
$a_0 = 1 \quad a_1 = 1 \quad a_2 = 0$.
d) Does this circuit generate a m-sequence?
e) Calculate autocorrelation of the output sequence.
f) Calculate power spectrum of the output sequence.
g) How much the interference from other user will be suppressed when the users have spreading code described above but the codes have different phases?

Reference:
R.L. Peterson, R. Ziemer, D. Borth: "Introduction to spread spectrum communications" 1995. pages 695. chapter 3.