Unit 7 - Principles of CDMA and MIMO Wireless Communication

Assignment 6

Due on: 2018-10-08, 23:59:59 IST

Course Code: 01

Problem 6.12

Given a two-user CDMA system with spreading sequences

\[ a_1 = \{+1, -1, -1, +1\} \]
\[ a_2 = \{-1, +1, +1, -1\} \]

Find the interference. Show that the resulting signal power is equal to the sum of signal power of the two users

Solution:

Interference power (I)

\[ I = a_1^H a_2 \]

\[ = (+1)(-1) + (-1)(+1) + (-1)(+1) + (+1)(-1) \]

\[ = -1 - 1 - 1 - 1 \]

\[ = -4 \]

Signal-to-Interference Ratio (SIR)

\[ SIR = \frac{P_s}{P_i} \]

where \( P_s \) is the signal power and \( P_i \) is the interference power.

\[ SIR = \frac{P_s}{-4} \]

\[ = -\frac{P_s}{4} \]

Thus, the interference power is -4, and the SIR is -\( \frac{P_s}{4} \). The resulting signal power is equal to the sum of signal power of the two users.

Problem 6.13

Consider a CDMA system with two users \( i = 1, 2 \), where the channel coefficients for the \( i \)-th user are \( h_i = x_i + y_i \) and \( d_i \)

Power of each user is \( \tau \). Spreading length is \( L = 4 \). What is the SINR of user 1? The DB Noise power \( \sigma^2 = -128 \)dBm

Solution:

The SINR for user 1 can be calculated using the formula

\[ SINR = \frac{P_s}{\sum_i P_i + N} \]

where \( P_s \) is the signal power, \( P_i \) is the interference power, and \( N \) is the noise power.

\[ P_s = \tau \]

\[ P_i = \sum_i \tau \]

\[ N = -128 \text{dBm} = 10^{-128} \text{W} \]

\[ SINR = \frac{\tau}{\sum_i \tau + 10^{-128}} \]

\[ SINR = \frac{\tau}{\tau + 10^{-128}} \]

Thus, the SINR for user 1 is \( \frac{\tau}{\tau + 10^{-128}} \).