Alexandria University
Faculty of Engineering
Electrical and Electronics Engineering Department
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جامعة الإسكندرية
كلية الهندسة
قسم الهندسة الكهربية
الفصل الدراسى الأول, 2023/2022

BONUS PROJECT

The goal of the project is to select one of the two topics and prepare a report on. The deadline for the report is on Dec, 28th, 2023.

Topic 1: Effect of carrier frequency offset (CFO) on OFDM signal

One of the main critical points against OFDM transmission is the fact that it is very susceptible to impairments that can quite degrade its performance. One such impairment is Carrier Frequency Offset (CFO), where the carrier used by the receiver has a frequency that is shifted by Δf from the frequency of the transmitter carrier. In this topic, you need to explain the effect of the CFO mismatch on the decoding of the OFDM signal and how this Δf can be 1) estimated by the receiver, and 2) compensated for.

Topic 2: MMSE estimation of the channel coefficients using multiple transmitted pilots in one coherence time

Channel estimation is an integral part of any wireless communication system. The process of channel estimation refers to the receiver attempt to get an estimate of the channel experienced by the transmitted symbol. Following the single tap discrete channel model used in the lecture, we know that the receiver can utilize the notion of coherence time for detecting the channel coefficient prior to transmitting data symbols. In this topic, you need to explain how this estimation is done to achieve the MMSE criterion.

1) Explain what is the theory of MMSE estimation and how it relates to channel estimation.
2) How can we use multiple pilots per coherence time to find the optimal MMSE estimation.
3) Now, assume that the channel correlation in time is not as simple as the notion of coherence time, but rather it follows the well-known Jake's model for time correlation. Explain how this can be taken into account to find the MMSE estimate of the channel.