

EDC310
Practical Assignment 2

7 September 2020

Compiled by Prof HC Myburgh

Introduction

You are to develop a simulation platform¹ for a communication system transmitting information over an additive white Gaussian noise (AWGN) multipath channel.

Use the simulation platform developed in *Practical 1* to develop a simulation platform that includes the effect of multipath in the received signal, where the channel impulse response (CIR) length is $L = 3$. Determine the t th received symbol by

$$r_t = s_t c_0 + s_{t-1} c_1 + s_{t-2} c_2 + \sigma \left(\frac{\varkappa + j\varkappa}{\sqrt{2}} \right) \quad (1)$$

where s_t is the t th transmitted symbol and $\mathbf{c} = \{c_0, c_1, c_2\}$ is the CIR. Moreover, σ is the noise standard deviation and \varkappa is a sample drawn from zero mean unity variance Gaussian distribution.

Two CIR types should be used - static and one dynamic. The CIRs are given below:

$$\mathbf{c}_{static} = \{0.89 + j0.92, 0.42 - j0.37, 0.19 + j0.12\} \quad (2)$$

$$\mathbf{c}_{dynamic} = \left\{ \frac{\varkappa + j\varkappa}{\sqrt{2.3}}, \frac{\varkappa + j\varkappa}{\sqrt{2.3}}, \frac{\varkappa + j\varkappa}{\sqrt{2.3}} \right\} \quad (3)$$

$\mathbf{c}_{dynamic}$ is generated anew for every transmitted data block.

Develop the DFE and MLSE detection algorithms to determine the most probable sequence of transmitted symbols. Do this for BPSK, 4QAM and 8PSK modulation. The length of the transmitted symbol sequence, excluding header/tails symbols should be $N = 200$. Determine and plot the BER in the range $[0;15]$ dB for each modulation scheme using both CIR types.

¹All software must be developed in *Python*.

Deliverables

- Write a report using \LaTeX . Reports that are not written using \LaTeX will not be marked.
- Implement and evaluate your detection algorithms and report on your findings. Be concise and use proper grammar.
- Include your code as an appendix using double columns.

Instructions

- All reports must be in PDF format and be named report.pdf
- Name the source code files DFE.py and MLSE.py.
- Place the software in a folder called SOFTWARE and the report in a folder called REPORT
- Add the folders to a zip-archive and name it EDC310_prac2_groupnr.zip.
- The submission deadline is Friday 9 October at 23:59. Submission instructions to follow.
- Do not copy! The copier and the copyee (of software and/or documentation) will receive zero and disciplinary action will follow for both parties.
- For any questions, please make an appointment with me Prof Myburgh or Mr Dube.
- Make sure that you thoroughly discuss the results that are obtained. This is a large part of writing a technical report.