EDC310

Practical Assignment 2

28 August 2018

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Scenario

You are to develop a simulation platform[1] for a BPSK communication system over an additive white Gaussian noise (AWGN) multipath channel.

Use the BPSK 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 kth received symbol by

$$r_k = s_k c_0 + s_{k-1} c_1 + s_{k-2} c_2 + \sigma Gauss(); \tag{1}$$

where s_k is the kth transmitted symbol and $\mathbf{c} = \{c_0, c_1, c_2\}$ is the CIR. Moreover, σ is the noise standard deviation and $Gauss()$ is the function used to generate zero mean unity variance Gaussian random variables.

Use the Viterbi MLSE algorithm and decision feedback equalization (DFE) to develop two equalizers that can determine the most probable sequence of transmitted symbols. The length of the transmitted symbol sequence, excluding tail symbols, is $N = 300$

For this practical you must also compare the effect of a linearly declining CIR to that of a randomly generated CIR. Use a CIR of $\mathbf{c} = \{0.89, 0.42, 0.12\}$. for the linearly declining CIR, and generate a random CIR by using the following formula

$$c = \{\frac{RNG(\sigma)}{\sqrt[2]{3}}, \frac{RNG(\sigma)}{\sqrt[2]{3}}, \frac{RNG(\sigma)}{\sqrt[2]{3}}\} \tag{2}$$

where RNG is the normally distributed number generator you created in Practical 1 and $\sigma = 1$.

Generate a new CIR for each data block ($N = 300$) you tranmit. Compare the effectiveness of DFE to Viterbi for both the linearly declining CIR and the randomly generated CIR. Report on your findings. Provide a detailed analysis. Be concise and use proper grammar.

Deliverables

- Write a report using LATEX. Reports that are not written using LATEXwill not be marked.

- Include your code as an appendix using double columns.

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[1]All software must be developed in *Python*.

Instructions

- All reports must be in PDF format and be named report.pdf

- 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 studnr_EDC310_prac2.zip.

- All reports and simulation software must be e-mailed to *edc310.2018@gmail.com* no later than 28 September 2018. No late submissions will be accepted.

- Submit your hard copy in class or at the Eng III 7-31.

Additional Instructions

- Do not copy! The copier and the copyee (of software and/or documentation) will receive zero for both the software and the documentation. Z-e-r-o.

- For any questions or to make an appointment, email me at *u14006007@tuks.co.za*

- Make sure that you discuss the results that are obtained. This is a large part of writing a technical report

Marking

Your report will be marked as follows:

- 50% will be awarded for the full implementation of the practical and the subsequent results in the report. For partially completed practicals, marks will be awarded as seen fit by the marker.

- 50% will be awarded for the overall report. This includes everything from the report structure, grammar and discussion of results.