Call for Master Thesis on the subject of: “Comparison of FFE/DFE adaption algorithm performance for equalization of different channel types”

Date of initial posting of this proposal: July 2009

The thesis will be carried out entirely in Germany. For preliminary information anyway please contact roberto.gaudino@polito.it (tel. 4172)

Description

All channels, which suffer from frequency selective attenuation within the band of interest, introduce linear distortion into a communication system. The most common characteristic among these channels is the low pass. These low pass channels can be sorted into the range spanned by the two extreme cases:
- Channel type A: 3dB-bandwidth very low compared to band of interest, but only moderate attenuation at higher frequencies
- Channel type B: 3dB-bandwidth close to band of interest, but strong attenuation at higher frequencies

As an additional attribute, each of the channels can have a transfer function with a non-monotonic slope, e.g. can contain peaks or notches. In this thesis, only real baseband channels will be considered.

To overcome the linear distortion of the channel, equalizers are being used. The focus in this thesis lies on finite impulse response (FIR) filters that are being continuously adapted in their filter coefficients. There are two types used: the Feed Forward Equalizer (FFE) and the Decision Feedback Equalizer (DFE).

The objective of this thesis is to investigate and evaluate the behaviour of several adaption algorithms with respect to their equalizing performance within the range of above named channels. The respective behaviour shall be compared to a reference. This will be the equalizer performance under perfect channel knowledge (using analytic adaption).

In the first practical scenario, the equalizer performance will be evaluated under perfect knowledge of the transmitted signal (trained or data-aided adaption).
In the second practical scenario, the equalizer performance will be evaluated without knowledge about the transmitted signal (decision-directed or data-less adaption).

The quality criterion of the equalization performance will be the available eye opening for symbol detection below a given symbol error ratio (SER).
However, the evaluation shall pay attention to aspects of implementation complexity:
- The number of taps in the FIR filter.
- The hardware necessary to obtain the error signal (and other input data for the adaption algorithm).
The student can build on an already implemented class framework for FIR equalizers in Matlab. To solve the objective of the Master thesis, the student will refine this framework. He/She will furthermore develop and implement the algorithms under investigation and evaluate the performance through analysis and simulation.

**Special prerequisites:**
It is obligatory for this thesis that the student has:
- an advanced knowledge and practice in the Matlab programming language
- fundamental knowledge on data transmission, digital signal processing and filter theory
Basic knowledge in analog circuit design would be helpful.

**Allowance:**
The master student can choose between either a salary or free accommodation. The salary would be 757.66 € per month and would be paid for a maximum of 6 month. In order to reserve the student’s accommodation, it is necessary to apply at least 2-3 month in advance.

**Contacts:**
The thesis will be carried out at:

Fraunhofer Institut für Integrierte Schaltkreise (IIS) / Institute for Integrated Circuits
Am Wolfsmantel 33
91058 Erlangen
Germany
[http://www.iis.fraunhofer.de](http://www.iis.fraunhofer.de)

The Fraunhofer Institut tutor will be:
Conrad Zerna
Tel.: +49-9131 776-9211
[Conrad.Zerna@iis.fraunhofer.de](mailto:Conrad.Zerna@iis.fraunhofer.de)