Popular science summary of Analysis of the finite length performance of spatially coupled convolutional codes

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The effect of spatial coupling on convolutional codes, ensembles and simulation of bit error rate.

Which type of codes will be used in the next generations of mobile communication or in the deep space links? Spatially coupled convolutional codes promise good result to be considered as a competitor.

Considering a chain of encoding blocks, spatial coupling is a technique used to combine each encoding block with its neighbors. This technique gives a significant bit error rate performance (BER) improvement over non-coupled ensembles. Transmitting long sequences of bits will achieve performance close to the capacity, for instance the results of our simulation beat the performance of the code used in LTE (4G).

A rate 1/2 and a rate 2/3 encoders where implemented, as well as their corresponding decoders based on the BCRJ algorithm. These were used as a component encoder/decoder for all constructions.

Furthermore two different kinds of codes, parallel concatenated codes (PCC) and braided convolutional codes(BCC) were constructed. Three different ensembles for coupled codes, one spatially coupled parallel concatenated codes and two different types of spatially coupled braided convolutional codes were under analysis.

In order to visualize the results, a simulation environment was created where we estimated the bit error probability of all the ensembles under different noise levels. Since the computation time for these simulations was very high, we used the Alarik lunarc cluster facilities based in Lund university. The simulation program was implemented in Matlab and the BCJR algorithm in C++. All the points for the different constructions were plotted in figures. With the help of the figures the performance of the different ensembles were analyzed.

The final result of this project will contribute not only to the department research but to the general knowledge on the field and is one step forward in the current research of the feasibility of spatially coupled codes.