

Advanced Topics in Telecommunications

LDPC Codes

This work considers the theoretic analysis, implementation and performance evaluation of LDPC codes. It is divided in 4 phases:

1) Basic concepts

This phase aims to give the basic concepts of LDPC codes and decoder. The student should start with a simple rate $1/2$ or $3/4$ LDPC code with relatively small blocks (around 16). The generator matrix, parity check matrix and Tanner graph are obtained and the error correction capabilities are studied.

2) Belief propagation decoding

A simple belief propagation decoder for the codes of phase 1) is implemented using hard decisions. The impact of loops in the Tanner graph should be studied.

3) Implementation of a general encoder and decoder

An encoder and decoder for LDPC codes with different lengths and Tanner graphs is implemented.

4) Performance evaluation

The impact of block length, rate and structure of LDPC codes on the performance is studied by simulation.

Main bibliography:

T. Moon, Error Correction Coding: Mathematical Methods and Algorithms, Wiley, 2005