ABSTRACT

This thesis proposes new Raptor codes design suitable for uplink Internet of Things (IoT) using single carrier transmission technique (SC-IoT) with low density parity check (LDPC) codes as the precode of Raptor codes, called LDPC-Raptor codes. The utilization of LDPC as the precode is to guarantee high capability of error correction for better Raptor codes performance while the keeping total computational complexity low. Raptor Codes are preferable for SC-IoT because of their flexibility of both fixed/non-fixed rate (rateless) and simplicity in decoding.

The degree distributions of LDPC-Raptor codes are designed optimally using Extrinsic Information Transfer (EXIT) chart to meet requirements of SC-IoT. The optimization is based on the maximization of coding rate with subject to no intersection point between EXIT curves of the corresponding evaluation point. We conduct computer simulations to evaluate the performances of the proposed codes. The performances are evaluated based on soft decoding using log-likelihood ratio (LLR) over additive white Gaussian noise (AWGN) and frequency-flat Rayleigh fading channels. We evaluate bit-error rate (BER) and frame error rate (FER) performances using the fifth telecommunication generation (5G) new radio (NR) complex binary phase shift keying (BPSK) and quadrature phase shift keying (QPSK) modulations.

A series of computer simulation is conducted to evaluate the performances of the proposed LDPC-Raptor codes by considering practical parameters. We found that BER and FER performances with the given iteration number have maximum performance and close to the Shannon limit. The effect of the increase of number iteration and the number of block-length are also evaluated on the error correction capability to improve the performances. The evaluation of BER and FER performances also confirm that the degree distributions used in the proposed LDPC-Raptor codes are good and suitable for future SC-IoT. All results indicate that the proposed LDPC-Raptor codes are potential solutions for future IoT wireless networks having high performances.

Keywords: *Raptor codes*, *LDPC*, *EXIT Chart*, *Internet of Things*.