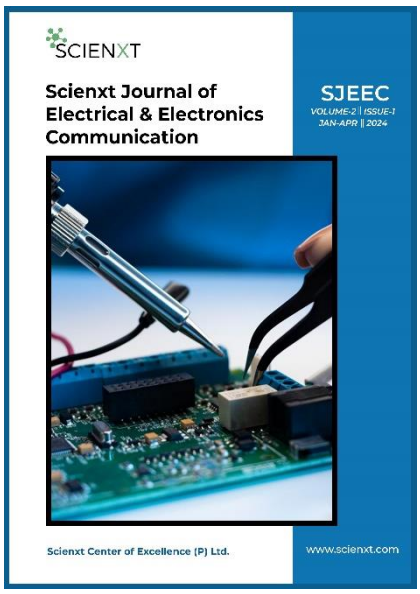

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Design of low-density parity check codes for 5G technology

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Abstract:

Channel coding plays a vital role in telecommunication. Low-Density Parity-Check (LDPC) codes are linear error-correcting codes. According to the 3rd Generation Partnership Project (3GPP) TS 38.212, LDPC is recommended for the Fifth-generation (5G) New Radio (NR) shared channels due to its high throughput, low latency, low decoding complexity and rate compatibility.

LDPC encoding chain has been defined in 3GPP TS 38.212, but some details of LDPC encoding chain are still required to be explored in the MATLAB environment. For example, how to deal with the filler bits for encoding and decoding. However, as the reverse process of LDPC encoding, there is no information on LDPC decoding process for 5G NR shared channelsin 3GPP TS 38.212. In this thesis project, LDPC encoding and decoding chains were thoughtfully developed with MATLAB programming based on 3GPP TS 38.212. Several LDPC decoding algorithms were implemented andoptimized. The performance of LDPC algorithms was evaluated using blockerror rate (BLER) v.s. signal to noise ratio (SNR) and CPU time.

Results show that the double diagonal structure-based encoding method is an efficient LDPC encoding algorithm for 5G NR. Layered Sum Product Algorithm (LSPA) and Layered Min-Sum Algorithm (LMSA) are more efficient than Sum Product Algorithm (SPA) and Min-Sum Algorithm (MSA). Layered Normalized Min-Sum Algorithm (LNMSA) with proper normalizationfactor and Layered Offset Min-Sum Algorithm (LOMSA) with good offset factor can optimize LMSA. The performance of LNMSA and LOMSA decoding depends more on code rate than transport block.

Keywords:

New radio (NR), Shared channel, Channel coding, Low-Density Parity-Check (LDPC) codes, Layered Normalized Min-Sum Algorithm (LNMSA), Layered Offset Min-Sum Algorithm (LOMSA)