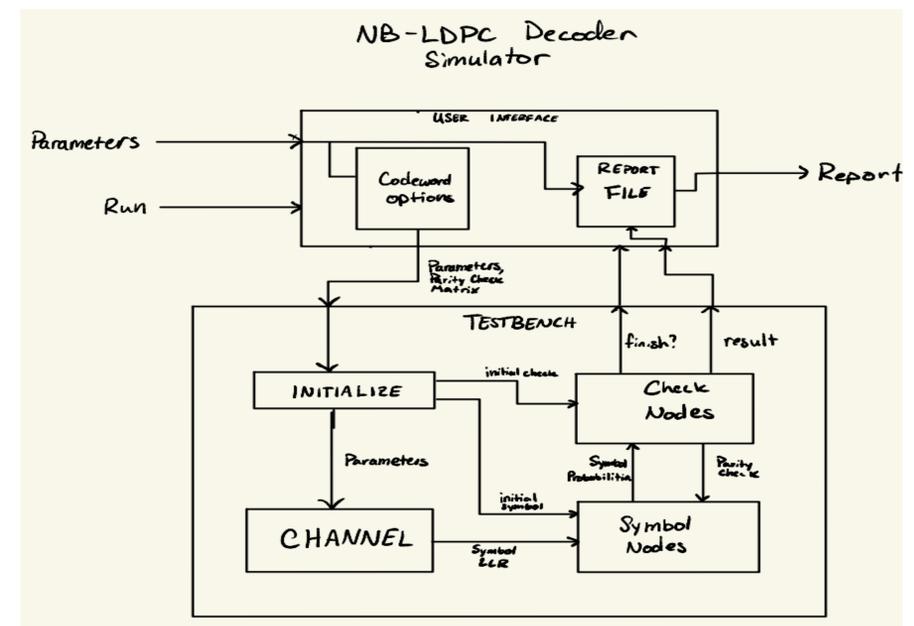


NB-LDPC Decoder Simulator

Project

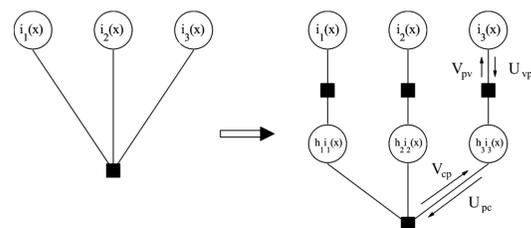
- Modern communication systems require increased reliability and speed to meet the large loads placed upon them.
- Error correction coding is a method of encoding data in a way that allows the data to be recovered at the receiving end if there is an error during transmission.
- Low-density parity-check (LDPC) codes are a form of error correction coding that are used in many communication and storage technologies.
- LDPC codes operate on groups of bits are known as non-binary LDPC (NB-LDPC) codes and may improve communication speed.
- This project aims to facilitate research into NB-LDPC schemes by developing software that will simulate the hardware of a non-binary LDPC decoder.

System



Methods

- This simulator was prototyped in Python and implemented using SystemC.
- The project implements the belief propagation algorithm for a Galois Field size of 2^A .
- The structure of the NB-LDPC code follows the structure of binary LDPC codes with the parity check matrix entries being replaced by randomly selected elements of the given field.
- The simulator implements the Belief Propagation algorithm.
- To reduce the computational complexity, a look-up table was constructed for each check node.



Effect of non-zero parity-check matrix entries

Conclusion

- This project was successful in informing the author of advances in the field of non-binary LDPC codes.
- A method of generating a look-up table to reduce computational complexity.
- Unfortunately, the simulator was not completed enough to yield any numerical results, but should be completed in the next month.
- Future research will focus on implementing novel decoding algorithms and testing them with this simulator.

D. Declercq and M. Fossorier, "Decoding Algorithms for Nonbinary LDPC Codes Over $GF(q)$," in IEEE Transactions on Communications, vol. 55, no. 4