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Abstract

Engineering and the Built Environment
School of Electrical and Information Engineering

Master of Science

Investigation of the use of Infinite impulse response filters to construct linear block codes

by Aneesh Chandran

The work presented extends and contributes to research in error-control coding and information theory. The work focuses on the construction of block codes using an IIR filter structure. Although previous works in this area uses FIR filter structures for error-detection, it was inherently used in conjunction with other error-control codes, there has not been an investigation into using IIR filter structures to create codewords, let alone to justify its validity. In the research presented, linear block codes are created using IIR filters, and the error-correcting capabilities are investigated. The construction of short codes that achieve the Griesmer bound are shown. The potential to construct long codes are discussed and how the construction is constrained due to high computational complexity is shown. The G-matrices for these codes are also obtained from a computer search, which is shown to not have a Quasi-Cyclic structure, and these codewords have been tested to show that they are not cyclic. Further analysis has shown that IIR filter structures implements truncated cyclic codes, which are shown to be implementable using an FIR filter. The research also shows that the codewords created from IIR filter structures are valid by decoding using an existing iterative soft-decision decoder. This represents a unique and valuable contribution to the field of error-control coding and information theory.