ABSTRACT

This undergraduate thesis proposes new Raptor codes based on low density generator matrix (LDGM) to support the Internet of Things (IoT) using single carrier transmission scheme, called single carrier-IoT (SC-IoT). IoT is a future technology supported by Machine-to-Machine (M2M) communications and is involving billions of interconnected devices on the Internet.

Raptor codes are simple codes having good correction capability. Raptor codes are selected in this thesis because of their potentials as: (i) internal error correction codes in each device, and (ii) external or network error correcting code. The main target of this Final Project is to develop Raptor codes for internal devices. However, it is expected that some results from this thesis are applicable for the design, analysis, and further development of Raptor codes-based network coding. The proposed technique in this thesis is devoted to SC-IoT, since single carrier transmission has advantages of simplicity in the design and is suitable to provide long term battery life services.

This thesis proposes Raptor codes for SC-IoT devices with new (sub)optimal degree distribution, obtained from extrinsic information transfer (EXIT) analysis. We found that the performances approach the Shannon limit leading to avoid wasting power in the transmission. Raptor codes consist of precode and Luby Transform (LT) codes. This thesis designs the precode using LDGM codes, which is then called the LDGM-Raptor codes in this thesis. The LDGM-Raptor codes are designed (sub)optimally to meet the requirement of SC-IoT with low bit-error rate (BER), and outage probability but with high throughput. This thesis also evaluates the performances of the LDGM-Raptor codes with the Shannon limit, derived from its channel capacity, to confirm the suitability of the proposed LDGM-Raptor codes to the future wireless network requirements.
Keywords: Internet of Things, LDGM codes, Raptor codes, EXIT chart.