ABSTRACT

This thesis considers future wireless super-dense network for Internet of Things (IoT) involving machine and human communications, where humans are prioritized over machines in future networks. This thesis proposes a new concept of network coding scheme based on maximum distance separable (MDS) codes with optimal degree distributions. The utilization of MDS codes are motivated by the requirement of high data rate transmission with a code rate beyond 0.5 for broadband applications.

The MDS codes for prioritizing human are designed optimally using projected extrinsic information transfer (EXIT) chart to obtain simple optimal degree distribution and low packet-loss-rate (PLR). This thesis considers Coded Random Access (CRA) as a fundamental multiple access scheme for super-dense networks.

Computer simulations are performed for the proposed scheme under binary erasure channel (BEC) to model a network with possible erased packets. The results are then verified using practical channel of frequency-flat Rayleigh fading. The results of this thesis are: (i) evaluation of several values of utility function given the finite length of time slots and size of the networks, (ii) the optimal simple degree distribution for group of humans and machines, in terms of packet-loss-rate (PLR) and throughput for every group.

We found that the proposed simple optimal degree distributions for group of humans and machines work well with prioritization to humans indicated by low PLR and high throughput for the humans, which are valid both in additive white Gaussian noise (AWGN) and frequency-flat Rayleigh fading channels. These results are expected to be useful for future applications of IoT super-dense networks.

Keywords: *MDS Codes*, *EXIT chart*, *Internet-of-Things*, *prioritization*, *iterative decoding*