ABSTRACT

This thesis investigates interference mitigation techniques in wave-based communication in Unmanned Aerial Vehicle (UAV) and Over The Horizon (OTH) applications, as well as in particle-based communication in molecular communications applications. Wave-based and particle-based communications are both subject to interference, either due to internal or external sources of interferences. Interference occurs when the primary signal is disrupted by another signal, so that this interference can reduce the quality of communication. Some common types of interference in communication systems are, for example, inter-symbol interference (ISI), inter-carrier interference (ICI), inter-block interference (IBI) and interference between cells (IBC). To overcome various types of interference, this thesis proposes interference mitigation techniques for several applications. For applications in molecular communications, this thesis proposes low density parity check (LDPC) codes based on chemical reactions to reduce ISI. For OTH applications, this thesis proposes a 2x2 Multiple Input Multiple Output (MIMO) array antenna design to obtain large channel capacity while mitigating the Doppler effect that occurs in rocket communications.

This thesis simulates molecular communications through free diffusion channel with various parameters including distance, number of molecules, and modulation type using computer simulation to determine the performance of bit error rate (BER) which indicates the quality of molecular communications. For applications in OTH, this thesis creates a MIMO antenna array design using computer simulation.

This thesis perform a series of computer simulations and found that successful decoding of chemical reactions LDPC (CR-LDPC) codes provides 4000 molecules reduction for the same level of performance compared to the communications of without CR-LDPC codes. These results indicate that chemical reactions replicating the box-plus operation have strong potential for further use and development of molecular communications. The performance of the MIMO antenna array shows that the proposed antenna has good potential as a means for DSC in improving communication reliability for high-speed rockets. These results are expected to contribute to the development of practical communication technologies for use in rockets and other high-speed devices, as well as being a significant contribution to the development of molecular communications for the medical field.
Keywords: Interference, Molecular Communications, OTH, BER.