ABSTRACT

Recent wireless standards are the candidate technologies to fulfill the ever increasing data rate demands in wireless cellular networks. Compared to the previous release of 3GPP community, the Fourth Generation (4G) standard introduces the deployment of Relay Nodes (RNs) in order to improve the radio capacity, to enlarge the cell coverage and to increase cell-edge throughput. It provides system bandwidth beyond 20 MHz. The next generation cellular system specifies spectrum allocations of up to 100 MHz using carrier aggregation technique where multiple carrier components are combined. It adds feature functionality and performance enhancements to current standard and promotes better experience. The key next generation wireless communication systems include Waveform generation techniques, Massive MIMO enhancements and relaying.

Relay is a key enabling technology which enables next generation networks to improve the performance in terms of coverage and capacity. Relaying has been identified as an efficient technique to provide cooperative diversity and schemes such as Amplify-and-Forward (AF), Decode-and Forward (DF), Compress-and-Forward (CF), Demodulate-and-Forward are normally used in practice. Later on, Decode-Compress-Forward (DCF), Decode-Amplify-Forward (DAF) relaying protocols have been studied with selective cooperation. Selective cooperation provides higher channel gain based on source-relay link. To improve the system performance in terms of throughput, spectral efficiency and data rate, incremental relaying schemes are introduced.

In addition to the above schemes, the cooperative gain could be improved with the help of incremental hybrid relaying scheme. In this scheme, feedback mechanism is incorporated to improve the performance of the system. In this thesis, an Incremental Hybrid Decode-Amplify-Forward (IHDAF) relaying scheme is proposed to achieve reliable communication, which values the user's

Quality of Service (QoS) like channel and outage capacities. Also, the IHDAF relaying scheme is integrated with polar code and successive cancellation (SC) decoder, in which the capacity could be further improved. The polar coded Incremental Hybrid Decode-Amplify-Forward (IHDAF) relaying scheme is designed using single and multiple antenna configuration systems

In the first module, the bit error rate performance and channel capacity of the proposed Polar Coded IHDAF (PC-IHDAF) relaying is analyzed using single and multiple antenna schemes. It is proved that the capacity of proposed PC-IHDAF relaying scheme is getting improved to 23 b/s/Hz as compared to traditional AF and DF relaying schemes.

In the next module, the proposed IHDAF relaying scheme is extended to multi-relay environment. In multi-relay scenario, Polar Coded Opportunistic IHDAF (PCOR-IHDAF) considered to investigate the effect of outage probability and outage capacity using Marcum-Q function. The conventional relaying schemes such as AF and DF relaying schemes are compared with proposed PCOR-IHDAF scheme. It is observed through simulation that the outage capacity is increased to 45 b/s/Hz in 8x8 MIMO environment and it is higher than AF and DF relaying schemes.

In the third module, the lauricella hypergeometric function is considered to derive the level of Error Vector Magnitude (EVM) in PCOR-IHDAF environment. The different combining schemes such as Equal Gain Combining (EGC), Selection Combining (SC), and Maximal Ratio Combining techniques (MRC) have been compared. From the simulation results, it is seen that the MRC technique has the EVM level -27.847 dBm which is superior to EGC and SC schemes. Further, the performance characteristics in terms of power spectrum and propagation time is analyzed using PCOR-IHDAF relaying protocol. It is inferred that the scatter motion is very less at -100 dBm of carrier frequency 6 GHz.

The performance analysis of the proposed IHDAF and OR-IHDAF relaying schemes in polar code environment shows outcomes of higher channel and outage capacities with reduced complexity. It is concluded that the proposed technique is a potential candidate to improve capacity and coverage in future wireless communication systems.