CHAPTER 7

CONCLUSION AND SCOPE FOR FURTHER RESEARCH

7.1 CONCLUSION

The fourth generation wireless networks pose difficult challenges in achieving better link reliability, resource utilization, fairness and computational complexity. The existing threshold-based scheduling achieves the required link quality at the cost of either high computational complexity or with less resource utilization. Some studies and investigations conducted on the threshold-based scheduling for multi-user MIMO systems were presented in this thesis.

The main findings of this research are;

A new proposed optimized threshold based fair scheduler (OTFS) grants resource for the active users whose SNR is more or equal to the required optimized SNR threshold. This scheduler achieves better link quality as compared to TFS without compromising fairness and complexity. The BER of this scheduler improved by 60% compared to TFS and 92% compared to PS when the available resource is equal to 80% of number of active users. But the resource utilization is 75% in case of OTFS whereas it is 100% in PS.

To improve the resource utilization without affecting the BER performance, an efficient scheduling (ES) was designed. This ES combines the better performance regions of PS and OTFS. Hence, always ES
performance is found to be better than PS and OTFS. The fairness of ES is found poor compared to OTFS but it is similar to PS. This scheme provides a network BER of about $5 \times 10^{-5}$.

Multi-threshold-based channel-aware scheduling (MTCAS) was proposed with the aim of attaining fairness in all regions along with resource utilization improvement. MTCAS considers two SNR threshold regions namely SNR$_H$ region and SNR$_M$ region for resource allocation. To achieve better BER performance, MTCAS first allocates resource to SNR$_H$ region users fairly and to improve the resource utilization, SNR$_M$ region users are assigned the available resource. It was found that MTCAS gives better BER performance with improved service fairness and resource utilization under resource constrained environment. This scheme provides a network BER of about $8 \times 10^{-5}$ when $L= 6$ and $N=23$. But, when $L= 6$ and $N=8$, this scheme achieves a network average BER of about $2 \times 10^{-4}$ only. MTCAS achieves 12% improvement in resource utilization compared to OTFS.

The proposed MPS considers multiple user parameters like user channel strength and user demand rate while scheduling. The main aim of MPS is to improve the link level performance without affecting resource utilization and fairness. MPS considers six user regions out of nine user regions. This MPS scheduler first maximizes the minimum demand data rate user whose channel strength is high to achieve better BER performance. From the simulation, it was found that MPS outperforms other scheduling schemes in average BER, PDR performance. This scheme provides a network BER of about $3 \times 10^{-5}$ and PDR of 97%. Also it was observed that the average BER performance of MPS is $3 \times 10^{-5}$ when $L=6$ and $N=22$. This is around 62% improvement compared to MTCAS and 25% improvement compared to OTFS. MPS resource utilization was 89% when $L=9$ and $N=13$. This is
similar to MTCAS resource utilization performance but it is improved by 12% compared to OTFS at this point.

MPS in network centric MU-MIMO system was described with a view to utilize the unutilized resource of one base station through access controller. This multi-parameter based scheduler in every base station works based on users SNR strength and their demand rate. The performances of this scheme with BPSK modulations in flat Rayleigh fading channels were compared with MPS in non-network centric environment. From the simulation results it is found that MPS-nc outperforms MPS-wnc in BER performance by 55.8% when N=22 with L=9. This scheme provides a network average BER of about $3 \times 10^{-5}$.

### 7.2 SCOPE FOR FURTHER RESEARCH

Thus, the objective of BER improvement without affecting resource utilization is achieved by the newly proposed threshold-based scheduling techniques. In future, this work may be extended to study and evaluate the performance of various schedulers with adaptive modulation techniques. Also the performance of these schedulers may be evaluated with different coding techniques such as STTC, STBC etc. along with different pre-coding techniques. The performance of these schedulers may be evaluated for higher order MIMO networks.