Chapter 8

Conclusion

The rapid growth in the users of wireless mobile networks is compelling for the performance enhancement of these networks. It is very important to ensure that the available radio spectrum is used optimally by proper utilization of channels available. The role of channel allocation scheme is to allocate channels to the cells in such a way that will minimize the call blocking probability (CBP) for an incoming call. These schemes are classified in three categories as Fixed Channel Allocation (FCA), Dynamic Channel Allocation (DCA) and Hybrid Channel Allocation (HCA). FCA allows channel to each cell permanently in a manner that maximizes the frequency reuse by keeping acceptable reuse distance whereas in DCA, the channels are allocated dynamically as call arrives. DCA makes cellular system more efficient particularly if the traffic distribution is unknown or changes with time but requires more complex control. In case of HCA, the cellular system channels are divided into two subsets, one use FCA and the other DCA. The ratio of fixed to dynamic channel set plays an important role in the performance of HCA. Detailed reviews of various extensions and combinations of these schemes are presented in Chapter 2. To minimize the CBP, the scheme must satisfy the
electromagnetic compatibility constraints such as hard and soft constraints as well as the traffic demand. The hard constraints includes co-channel, adjacent channel and cosite interferences whereas soft constraints includes packing condition, resonance and reassignment. The system performance predominantly reduces with increase of interferences as it significantly reduces the S/I ratio. The actual level of interference is not feasible to compute owing to computational complexities and changing environmental parameters. Therefore to minimize the effect of interferences, a process of optimization is formulated to satisfy these constraints. The detailed literature survey on constraints and various optimization techniques, like simulated annealing (SA), tabu search (TS), random walk (RW), neighborhood search (NS), genetic algorithm (GA) and particle swarm optimization (PSO), that are used in wireless mobile networks is discussed in Chapter 3. SA is based on thermodynamic considerations with annealing interpreted as an optimization procedure. The method generates a sequence of states based on cooling schedule for convergence; however the convergence behavior strongly depends upon the appropriate choice of various parameters, leading to poor performance. TS does an aggressive exploration of the solution space and direct the search in a desirable direction by avoiding inefficient paths which reduces computation time compared to SA. However this method requires large memory capacity where history set of individual is stored, which becomes insufficient for large scale cellular networks. RW does not store any information about the previously visited location in a search space and need to be coupled with other heuristic method to enhance the performance and thus is little used in wireless mobile networks. An iterative improvement in NS may take large time in large networks and the solution arrived may have a problem of local
optimalit. GA belongs to a class of evolutionary algorithm that uses techniques inspired by evolutionary biology, which implements survival of fittest. The weak individuals are rejected, which may result in random solution and convergence. PSO is a swarm based intelligent technique that takes advantages of collective behavior of insects, flocks of bird and schools of fish to solve algorithmically complex problems. No weak individuals are replaced here in successive iterations but are prompted to move towards the best position by sharing knowledge from the local best and global best individuals. Hence the entire swarm can converge to an optimal best solution. Various types of PSO are studied in Chapter 4. Taking the parameters for allocation and optimizing them using PSO, an optimum allocation scheme for hard and soft constraints was obtained as presented in Chapter 5. We have introduced a technique for accomplishing channel allocation problem on well known benchmark problems (HEX 1, HEX 3, KUNZ 1, and KUNZ 2). The study is done on the basis of dynamic inertia weight factor, call blocking and rejection rate. It was found that as compared to evolutionary algorithms, the time of convergence is reduced by considerable extent. The call admission and hand-off control for better Quality of Service (QoS) in cellular communication is investigated as discussed in Chapter 6. We introduced a modified distributed dynamic channel allocation (MDDCA) algorithm with adaptive reservation scheme considering both originating calls and handoff calls. This mechanism highly helps cluster cells to know the information on channel usage and sharing among the system. Such optimization facilitates better channel allocation based on global knowledge first followed by local knowledge. The simulations were carried out for HEX 1 and KUNZ 1 with respect to call blocking probability, call dropping probability and acquisition time in
comparative context of system with distributed DCA (DDCA) technique. A better optimized result has been obtained in MDDCA. In Chapter 7, dynamic pricing schemes considering the parameters for linear and non-linear pricing with feedback on the current pricing being applicable based on peak and off hours of traffic are studied. The prime issue is better spectrum utilization and reduction in congestion to make resources available with limited spectrum and increasing user demand. The outcome of the model is integration of call admission control with a dynamic pricing scheme which provides the better performance of the cellular networks compared to static pricing.

The presented research work has yielded the better performance for the channel allocation and hence the better optimized scheme for the parameter optimization. This thesis will play a vital role for real time analysis, implementation and design of the next generation channel allocation schemes. Some of the key contributions made by this research are as below:

- Optimum solution for channel selection is obtained at a faster rate compared to other algorithms and lower values of call rejection ratio are also observed. This improves the efficiency of system for call admission and ultimately the capacity of the system is improved.
- As compared to other evolutionary algorithms, the time of convergence is reduced significantly. PSO converges very fast and hence saves the time and maximizes the efficiency of the system.
- PSO based MDDCA with adaptive reservation and CAHO is proposed. The results exhibits that the blocking probability, dropping probability, and acquisition time is reduced as compared with DDCA algorithm.
The results show that the utilization of the dynamic pricing can significantly reduce the blocking probability and the congestion in the network. The proposed dynamic pricing method can be used as one of the measures to improve network utilization and fairness while addressing the issue of avoiding congestion. Results show that with dynamic pricing, congestion is reduced, call blocking probability is decreased and network utilization is increased. The scheme provides the user a choice to make a call based on its importance pertaining to the price. The nonlinear pricing method gives better results than the linear pricing method.

The results obtained are promising and can be implemented in real time scenario. For future work, there is a scope for using hybrid optimization and combinations of various constraints to improve the network performance further.