Power systems have the problem of deciding how best they can meet the varying power demand, which has a daily / weekly cycle from the generating plants such as hydro, thermal etc. Previously, to schedule generating units in a manner that minimizes costs while meeting all constraints and demands, the Unit Commitment (UC) algorithm was adopted. This work proposes the development of different algorithms for solving the unit commitment problem through hybrid intelligent techniques. In the solution algorithm, the Neural based Simulated Annealing (NBSA), the Neural based Tabu Search (NBTS), the Genetic Algorithm based Simulated Annealing (GASA), the Genetic Algorithm based Tabu Search (GATS), the Evolutionary Programming based Simulated Annealing (EPSA), and the Evolutionary Programming based Tabu Search (EPTS) methods are developed and used. The solution algorithm includes the advantages of individual algorithms and shows a reasonable combination of local search and global search. The objective is to find the generation scheduling such that the total operating cost can be minimized, when subjected to a variety of constraints. This also means that it is desirable to find the optimal generating unit commitment in the power system for the next H hours. Simulated Annealing (SA) is a powerful technique for solving combinatorial optimization problems. It has the ability of escaping local minima by incorporating a probability function in accepting or rejecting new solutions. Tabu Search (TS) is a powerful optimisation procedure that has been successfully applied to a number of combinatorial optimisation problems. It has the ability to avoid entrapment in local minima by employing a flexible
memory system (in contrast to 'memory less' systems, such as Simulated Annealing and Genetic Algorithm, and rigid memory systems such as branch-and-bound technique) The algorithm combines good solution qualities of Simulated Annealing and Tabu Search with rapid convergence quality of Artificial Neural Network. Genetic Algorithms (GA's) are general-purpose optimization techniques based on principles inspired from the biological evolution, using metaphors of mechanisms such as neural section, genetic recombination and survival of the fittest. In this algorithm, the unit commitment schedule is coded as a string of symbols. An initial population of parent solutions is generated at random. Here, each schedule is formed by committing all the units according to their initial status ('flat start'). Here the parents are obtained from a pre-defined set of solutions (i.e.) each and every solution is adjusted to meet the requirements. Then, a random recommitment is carried out with respect to the unit's minimum down times. By the combination of Genetic Algorithm with Simulated Annealing and Tabu Search will give the optimum and efficient solution. The GA combines good solution quality of TS with its rapid convergence quality. The GATS is used to implement and locate optimal or near-optimal solutions to typical optimization problems such as UCP. Evolutionary programming, which happens to be a Global Optimisation technique for solving Unit Commitment Problem, operates on a system, which is designed to encode each unit's operating schedule with regard to its minimum up/down time. The best population is selected by Evolutionary strategy. The EP combines good solution quality of TS and SA with its rapid convergence. A Thermal Power System with 7 generating units demonstrates the effectiveness of the proposed approach. Extensive studies have also been performed on different IEEE test systems consisting of 10, 26, and 34 thermal generating units, 66-bus utility system with 12 thermal generating units and also
on IEEE test systems consisting of 4 hydro and 7 thermal generating units. The numerical results obtained from the proposed hybrid algorithms were compared with the techniques like NN, SA, TS, GA, EP and other conventional methods like DP, LR. These compared results reveal that the proposed hybrid algorithms are more effective in terms of production cost and computation time. EPSA, one among the proposed hybrid algorithm is applied to solve the hydrothermal UCP.