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ANT COLONY OPTIMIZATION FOR SONET RING LOADING PROBLEM

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Abstract. *The SONET ring loading problem is a combinatorial optimization problem and is known to be NP-hard. The meta-heuristic method of ant colony optimization is a method of obtaining best/optimal solution, to NP-hard optimization problems. Hence, in this paper, we present, an ant colony system (ACS) for an effective search of the best/optimal routing of demands under a dynamic environment. Our simulation results show that this methodology is successful in finding the best/optimal routing of demands in a SONET ring. Three strategies ACS with only ranking, ACS with only MMAS, and ACS with both ranking and MMAS are considered. A comparison of these strategies are presented to show the performance of each strategy.*
Keywords: Ant colony optimization, Load balancing, SONET ring, Routing

1. **Introduction.** Modern telecommunication networks present the need for efficient load balancing/scheduling algorithms. A good load balancing/scheduling algorithm will improve the efficiency of the telecommunication network in terms cost and reliability. In this paper, we address the load balancing problem in a standardized synchronous optical network (SONET), which has attracted considerable attention in literature. A number of nodes connected by links in the form a ring is called SONET ring network. The nodes are numbered from 1 to n (in the clockwise direction), and the links are represented as $\{(1,2),(2,3),...,(n-1,n),(n,1)\}$. The demands can start at any node and has to be routed to another node in the network. There is a given number of demands (set of demands D), and each demand has an origination node (i) and a destination node (j), which implies that this demand has to be sent from node i to node j. Associated with each demand k in the set D, the amount of traffic to be routed is also known. In a SONET ring, a node j can be reached from node i in two ways: clockwise or counter clockwise. Hence, there are two classifications in the SONET ring namely unidirectional ring and bidirectional ring. In unidirectional ring all the demands are routed in the same direction (either clockwise or counter clockwise). In bidirectional ring each demand can be routed in either clockwise or counter clockwise direction. Hence, in a bidirectional ring, some of the demands can be routed in clockwise direction and the remaining demands can be routed in counter clockwise direction. The capacity of a ring is the maximum demand that pass through the links. In unidirectional ring the capacity is the sum of all the demands that arise in the network. So there is no load balancing problem in unidirectional SONET ring.