An Application of Integrated Multi-Objective Particles Swarm Optimization and Genetic Algorithm Metaheuristic through Fuzzy Logic for Optimization of Vehicle Routing Problems in Sugarcane Industry

Mukhtiar Singh, Sumeet Nagar

***Abstract*-**Vehicle routing problem (VRP) is a combinatorial optimization and nonlinear programming problem aiming to optimize decisions regarding given set of routes for a fleet of vehicles in order to provide cost effective and efficient delivery of both services and goods to the intended customers. This paper proposes the application of integrated particle swarm optimization (PSO) and genetic optimization algorithm (GA) to address the Vehicle routing problem in sugarcane industry in India.Suger industry is very prominent agro-based industry in India due to its impacts in rural livelihood and estimated to be employing around 5 lakhs workers directly in sugar mills. Due to various inadequacies, inefficiencies and inappropriateness associated with the current vehicle routing model it is costing huge money loss to the industry which need to be addressed in proper context. The proposed algorithm utilizes the crossover operation that originally appears in genetic algorithm (GA) to improve its flexibility and manipulation more readily and avoid being trapped in local optimum, and simultaneously for improving the convergence speed of the algorithm, level set theory is also added to it. We employ the hybrid approach to an example of VRP, and compare its result with those generated by PSO, GA, and parallel PSO algorithms. The experimental comparison results indicate that the performance of hybrid algorithm is superior to others, and it will become an effective approach for solving discrete combinatory problems.

***Keywords*-** Fuzzy Logic, Genetic Algorithm, Particle Swarm Optimization, Vehicle Routing Problem