

AS/PP/01

A Reformed Firefly Algorithm to Address the Symmetric Travelling Salesman Problem

Ekanayake EMKC¹, Ekanayake EMUSB¹

¹*Department of Physical Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Sri Lanka*

In computer science and operations research, the Travelling Salesman Problem (TSP) is a well-known combinatorial optimization problem that focuses on determining the shortest possible route visiting each vertex and returning to the starting point. TSP has applications in planning, logistics, transportation, microchip manufacturing and supply chain management, and etc.. In the domain of combinatorial optimization, exact methods like Branch and Bound and Dynamic Programming can provide optimal solutions, their practical applicability is limited by the growing number of vertices due to rising complexity. As a result, methods such as Genetic Algorithms, Simulated Annealing, and Ant Colony Optimization are commonly used to find near-optimal solutions efficiently. The Firefly Algorithm is a novel type of swarm intelligence that effectively addresses combinatorial optimization problems. It operates under the following key assumptions: fireflies exhibit unisexual characteristics and are mutually attractive, they move randomly when brightness is equal, and their attractiveness is proportional to brightness but diminishes with distance. For the TSP, this algorithm proposes an optimized path using a modified firefly approach. In this research study, a novel approach is proposed for creating a Hamiltonian cycle that changes the distances between edges based on the average value of the connected vertices and prioritizes edges by their attractiveness value in the modified firefly algorithm. The new approach reduces the number of iterations while ensuring high accuracy in solutions. When compared to exact methods such as Branch and Bound and Dynamic Programming, and approximation methods like Nearest Neighbors and Modified Hungarian method, our approach consistently offers more efficient and scalable solutions for the TSP.

Keywords: Attractiveness Value, Firefly Algorithm, Symmetric Travelling Salesman Problem