Project Number: 9

Project Title: Enhancing Genetic Search for A Novel Fuel Cell Vehicle Routing Problem

Project Clients: Boyu Liu

Project specializations: Computer Science and Algorithms;

Number of groups: 3 groups

Main contact: Boyu Liu

Background:

The increasing emphasis on sustainable transportation has led to the development of Fuel Cell Vehicles (FCVs) as a viable alternative to conventional internal combustion engine vehicles. However, the integration of FCVs into transportation networks introduces a new set of challenges, particularly in routing optimization due to limited hydrogen refueling infrastructure, energy consumption variability, and operational constraints.

Vehicle Routing Problems (VRP) is a classic problem widely studied in the field of transportation engineering, but the VRP for FCVs (FVRP) has not been studied well. As I am pushing forward the mathematical modelling of FVRPs, I find the solving the problem has no good ways, as nonconvex optimization by commercial solvers run for an unacceptable long time and evolutionary algorithms have difficulties in obtaining precise optimal solutions. Therefore, the goal of this project is to combine the advantages of both sides and achieve better computational performance.

Requirements and Scope:

1. Problem Definition: What is a FVRP, what is the mathematical model of it.

2. Optimization Framework: How to use genetic algorithm to solve problem and how to improve the performance.

Required Knowledge and skills:

Overall this project is an easy task with moderate algorithm and mathematical knowledge required. The students are expected to complete the following tasks:

1. Understand the mathematical model of FVRP (will be provided)

2. Use genetic algorithm (or hybrid genetic search or other GA variants) to solve a FVRP as benchmark

3. Find a way to improve the performance of GA on solving FVRP (directions can be given, details needs to be explored by the students)

Codes has to be either Python or MATLAB.

Expected outcomes/deliverables:

1. Source codes on GA solving FVRP (benchmark + improved method)

2. Report for this project including explanation of the model, the methodology of the improvement, and numerical results, comparisons are needed.