

Research master internship

Location of electric vehicle charging stations under uncertainties

Key words

Operations Research, Facility location, Electric vehicle charging stations, Bi-level programming, Mixed Integer Programming

Content

In order to reduce the CO₂ emissions caused by road transport, drivers are encouraged to use Electric Vehicles (EVs). However, one of the major barriers towards the large-scale adoption of EVs is their limited range, i.e. the maximum distance that a fully charged vehicle can travel before its battery runs empty.

A key element in making EVs more attractive is thus to deploy charging infrastructures consisting of stations where drivers can quickly recharge their battery. Nevertheless, building a station requires large capital expenditures. The locations of charging stations should thus be carefully selected to simultaneously maximize the coverage of EV trips and limit the investment costs.

The student will develop models and tools to help decision-makers in optimizing the design of EV charging infrastructures. Most existing works on this problem consider that the charging stations have an unlimited capacity, i.e. that they are able to serve all the flow of vehicles passing by, regardless of its intensity. This assumption may be acceptable in the earlier stages of EV introduction since the number of vehicles will be limited. But as EV adoption begins to take off, this assumption might become tenuous.

There is thus a need to incorporate the limited capacity of the charging stations in the problem formulation and to take into account the impact of the EV drivers' behavior on the available capacity. A preliminary study carried out in 2018 has led to the formulation of a bi-level integer program and to the resolution of small-size instances of the problem. The purpose of this internship is to develop an efficient solution approach in order to be able to solve medium to large size instances of the problem.

Context

This project will be a collaboration between LRI (Laboratoire de Recherche en Informatique www.lri.fr) at University Paris Sud and the college of Business and Economics at UAEU (United Arab Emirates University <http://www.uaeu.ac.ac/en/>). The student will be based on the Paris Sud campus (at the LRI) and will work under the joint supervision of Dr. Céline Gicquel (LRI) and Dr. Mouna Kchaou-Boujelben (UAEU). Therefore, frequent Skype meetings will be scheduled.

Desired qualifications

Student at Master's degree level (last year of engineering school or research master):

- Strong background in applied mathematics.
- Good knowledge in Operations Research: linear programming, integer programming, if possible bi-level programming
- Interest in computer programming (C++ language) and algorithmic.

Practical information

Location: Université Paris Sud - Campus d'Orsay - 91405 ORSAY Cedex
Start date : February 2019
Duration: 6 months
Payment: Around 500€ net per month

Contact

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References

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- [2] Locating road-vehicle refueling stations, Wang, Y. W. and Lin, C. C., Transportation Research Part E (2009) 821-829.