ST7- 74 – OPTIMIZATION OF PASSENGER TRANSPORT SYSTEMS

Dominante : Info&Num (Computer Science & Digital), GSI (Large Interacting Systems)
Langue d'enseignement : French
Campus où le cours est proposé : Paris-Saclay

Engineering problem

Transportation systems are essential to today's society because they provide crucial mobility services for both personal and business travel. The massification of travel and the diversity of mobility services, as well as new autonomous vehicles, make these systems complex to size, design and operate.

The optimization of such systems is therefore essential. For an airline, it is particularly important to be able to :
- take advantage of available information to forecast demand on "origin-destination" routes and define flight schedules that best cover the demand,
- Pricing flights to ensure the best possible fill rate and revenue management for the company,
- to size the services (check-in, baggage, ...) at the hubs allowing to operate the flight plans,
- planning flight crew schedules in accordance with legislation and crew preferences,
- assigning aircraft to flights in order to minimize costs, and being robust to possible delays.

Beyond the ability to operate efficiently, the engineer's role is also to inform strategic decisions through quantitative models evaluating different scenarios in which a company might choose to engage.

Adviced prerequisites

SIP and Algorithms and Complexity Course

Context and issue modules: These modules include an introductory lecture on the topic, presentations on the technological and scientific challenges of passenger transport optimization, and a presentation of related projects.

Specific course (60 HEE) : *Decision support / Operational research (AD/OR)*

Brief description : Optimization and decision making is an intrinsic activity of the engineer/manager profession. In order to understand the complex decision problems they will be confronted with, tomorrow's engineers and

managers must have the concepts and methods of optimization to formalize a decision problem. The course aims at introducing a certain number of classical models allowing to represent and solve decision problems in different contexts. The aim is to present models of different concrete decision problems.

Project: The project aims at putting the students in a real situation of solving a decision problem involving the formulation of a model, the choice of a resolution method(s), the implementation of a solution allowing a resolution on real data sets, the validation of the solution by numerical tests. The objective of the project through this activity is to make the students progress in the comprehension of the scientific, technical, but also human and economic stakes which underlie the implementation of a project of operational research and decision support in an organization.

Project n°1: *Optimization of rail transport operations*

- Associate partner: SNCF

- Location: Paris-Saclay

- Brief description: In rail transport, the implementation of passenger service involves dealing with various operational management problems: forecasting passenger demand, designing timetables, pricing seats, assigning trains to platforms in a station… These examples involve optimizing the operation of the transport system. The project will deal with one of these rail operations management issues.

Project n°2: *Optimization of an airline's operations*

- Associate partner: Air France - Operational Research / Artificial Intelligence Group

- Location: Paris-Saclay campus

- Brief description: This project deals with one of the multiple problems of managing the operations of an airline company: for example, assigning flights to boarding gates, placing passengers in a plane, assigning planned flights to a fleet of planes, etc.

Project n°3 : *Planning of a mobile team*

- Associated partner: Decision Brain

- Location: Paris-Saclay campus

- Brief description : The aim of this project is to design and implement a planning tool for a mobile team of technicians, initially planned to create the daily routes of 500 technicians who have to carry out some 10 000 tasks.