

# Optimal control management of the city urban networks.

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The thesis project can be for 1-2 MSc student. It can be started from December 2015/January 2016.

## Background

Managing a city is a hard task. It is even harder when many stakeholders are in control of different parts or levels of the city. KTH in the [European project PETRA](#), is building a participatory simulation for the cities of Venice and Rome. The participatory simulation allows several managers of the city, through twisting some control parameters, test collaboratively different strategies. The outcomes of the participatory simulations allow concluding on implementable strategies in real-life.

One of the reasons simulation is adapted is the belief that it can allow to find strategies that rely on the knowledge of humans with years of experience. However, for cognitive reasons, it is very plausible that humans can miss a lot of details when analyzing a situation. It will be then interesting to see how the outcomes of the participatory simulation will be different from the outcome of the optimal control/optimization techniques.

## Problem area and research questions

Relying on optimal control and optimization, one needs to make a lot of assumptions on the human behavior as well as reality simplifications in order to make the problems solvable within a reasonable time. Some research questions that can be addressed during the time of this thesis (or contribute to) are:

- How different are the solutions found using mathematical optimization from ones found using participatory simulation?
- What is the level of simplification and the number of assumptions that was needed in order to solve the problem, that was not made by the participatory simulation?

## Expected contribution

The main contribution that the students can come up with is the building of the most detailed mathematical model taking as many possible parameters as possible with less assumptions. The model should be solved and give possible strategies that can be tried on the simulation.

The student is only asked to provide the mathematical model(s), its/their solutions, and the practical meaning of it in the context of a simulation and real life. There will be a simulation on which the strategies that result from mathematical modeling will be tested.

## Key competences

The students should have at least some of these qualities:

Optimization, Integer Programming, Systems Engineering, Optimal Control, Operations Research, Programming (Java preferably). Any experience with GAMS, CPLEX.

## **Location**

This work will be done at [GaPSLabs](#) (Gaming and Participatory Simulation Labs), at [the school of technology and health](#), KTH.