Master thesis research project – Operation Research (ORCO) or Data Science (DS)

Title: numerical optimization for "smart grids" applications

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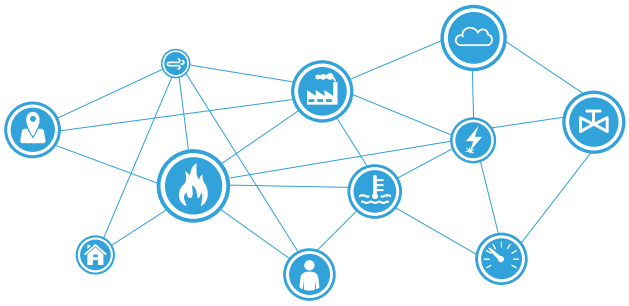
Context: The field of electricity (generation, distribution,...) raises several important optimization problems. New usages (e.g., local electricity generations, developments of electric cars,...) and new network technologies (e.g., smart meters) give new opportunities to control electricity distribution networks; this is a typical example of complexity of data and interplay between the network agents, so that this control has to be done by decentralized algorithms. A current project in Grenoble focuses on data-driven electricity distribution networks.



Objectives: The goal of the master thesis is primarily to design and develop an optimization algorithm for solving the non-linear equations that result from the modelling of the network. Related theoretical questions on sensitivity analysis and distributed optimization in the context of smart grid would also be considered.

More precisely, a first proof-of-concept non-linear solver has already been proposed within a smart grid simulator, but many improvements are needed, such as:

- better genericity, to allow the modeling of physical elements that cannot be represented today (lines, transformers and loads);
- a (theoretical and numerical) study of the sensitivity of the output, the accuracy of the algorithm, and the stopping criterion;
- the improvement of the robustness of the algorithm and the implementation of adequate performance tests to quantify efficiency gains.

Competences required: For this work, mathematical agility and programming skills are mandatory, but no prior knowledge of electrical engineering is necessary. All the expertise needed to model power network components are available from the host team. An interest in the field of energy, smart grids and the energy transition would be appreciated.

Practical information:

– Working place: LJK (on the Grenoble campus) in the team DAO (optimization and learning for data science) in close collaboration with G2Elab and LIG.
– Salary: the master student will get the usual salary and gratifications.
– This project opens up to a PhD thesis on related topics.

Keywords: numerical optimization, mathematical modeling, smart grids, distributed optimization