Course 4: Applied Mathematics and Optimization: Modelling and optimization algorithms in network design and energy planning

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Aim and Goals
Transportation and energy, between other goods, require the existence of distribution networks that must be carefully planned in order to satisfy a demand at the lowest cost, taking into account a set of specific requirements. The design of the network determines a routing scheme for the users and/or commodities whose repercussion has transcendence in the actual economic scenario and in the future expansions of the network. Optimization models can contribute to solve many complex planning problems. In particular, Integer Linear/NonLinear Optimization and Stochastic Optimization models are tools that allow us to efficiently deal with a large class of problems.

The course deals with the following topics:

1. Formulation of a general network design problem and review methods to solve it in addition to how to extend the model in order to handle different settings related to transportation and energy planning:
2. Introduction to design of optimal networks: network design models and solution algorithms.
3. Robustness and other challenges in the planning of transportation networks.
5. Main concepts and algorithmic frameworks for solving Mathematical Optimization problems under uncertainty via multistage stochastic mixed integer optimization as well as presenting strategies for risk reduction to minimize the negative impact of non-wanted scenarios (the-so named black swans) in Mathematical Optimization solutions for problems under uncertainty.

References