Optimisation

Component
École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

In brief

Code: N7EN12A

Presentation

Objectives

The objective of this module is to introduce the theoretical mathematical tools to characterize the local and/or global minima (or maxima) of a real-valued function, with the possible consideration of constraints on the state space.

From these general theoretical aspects, we will develop various algorithms for numerical optimization, and we will study their properties such as global convergence, convergence speed, etc. From a practical point of view, these algorithms will be implemented in the framework of practical work on computers, and tested on various particular problems.

Description

Following the results of the first year course, which gave the necessary/sufficient conditions characterizing the solutions of unconstrained optimization problems, we develop the Karush-Kuhn-Tucker-Lagrange conditions related to the characterization of the optima of a constrained function. These theoretical results are based on particular geometric concepts, such as the cone of admissible directions at a point in the constraint domain. We will analyze these geometrical aspects in detail in the construction of these mathematical results.

As for numerical methods for optimization, we will detail two types of algorithms, one for unconstrained problems, and the other with constraints. In both cases, we will study the convergence of these algorithms and we will focus on some practical aspects such as the choice of relevant stopping criteria, the scaling of the problem variables ...

The students will have the opportunity to familiarize themselves in depth with all the results presented in the framework of tutorial sessions, in which modeling issues and optimality conditions will be addressed on the basis of various practical optimization problems.

A significant amount of practical work will also allow students to implement numerical methods (confidence regions, augmented Lagrangian, etc.) and to test them for the treatment of optimization problems with constraints.

Pre-requisites

First year optimization course