

# Continuous optimization



Component  
École Nationale  
Supérieure  
d'Électrotechnique  
d'Électronique

## In brief

- > **AmetyS Code:** N9EE17F
- > **Open to exchange students:** Yes

## Presentation

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### Objectives

Understand and master optimization methods dedicated to solving continuous nonlinear problems.

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### Description

This course provides a brief overview of the state of the art in optimization methods for solving nonlinear and continuous problems. The various topics covered in the different chapters include:

- Formulating a single-objective optimization problem (without constraints), optimality conditions, and classification of the different methods used to solve a problem;
- One-dimensional optimization methods: interval subdivisions, quadratic interpolation, zero crossing of the objective function derivative;
- Gradient-based optimization methods: steepest descent, accelerated or conjugate gradient, Gauss-Newton or Quasi-Newton techniques;
- Geometric optimization methods: fixed or adapted directions during the search (Gauss-Seidel, Powell, Hooke & Jeeves), Nelder & Mead Simplex;
- Stochastic optimization methods: simulated annealing, evolutionary algorithms and nesting methods, particle swarms;

- Formulation of an optimization problem under inequality constraints: Lagrangian concept, KKT optimality conditions, penalization methods;
- Formulating a multi-objective problem: Pareto optimality, a priori decision on objectives (weighted objectives, epsilon constraint methods, global criterion method), a posteriori decision on objectives (using population-based algorithms), progressive or sequential techniques (lexicographic method).

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## Pre-requisites

Basic mathematical concepts related to functions with multiple variables, vector and matrix operators, and geometry.