Digital Automation Engineering

Optimization methods for data-driven engineering processes

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Data in engineering processes

Data are constantly produced, collected, stored, interpreted and used in most of the domains around us

Data are constantly collected also in production plants, by means of sensors and Manufacturing Execution Systems, and stored as big-data in Enterprise Resource Planning software

The need for optimization

- Starting from the collected data, an <u>optimization method</u> is an algorithm that can provide a solution to a decision problem faced by a company

- Optimization methods can help production in several ways
  - Fully use the collected data
  - Take decisions automatically
  - Take better decisions

- The development of an optimization method requires:
  1. Rigorous description of the problem
  2. Formulation of a mathematical model
 3. Development of a solution algorithm

Some examples

Vehicle Routing: a company producing Laser Guided Vehicles needs to manage the fleet routing

Warehouse management: A company distributing pharmaceutical products needs to decide how to store them in the warehouse

Production scheduling: A company operating with flexographic printing needs to schedule the next prints on a set of machines
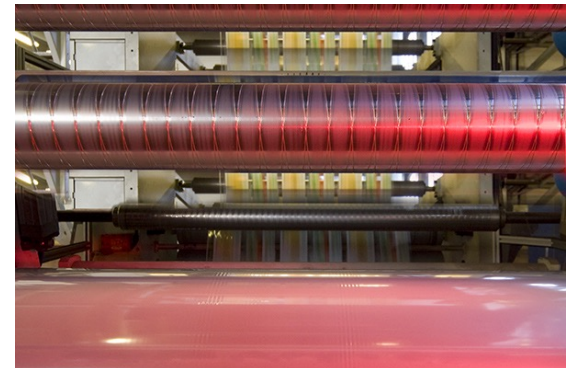
Aim of the course
Optimization methods for data-driven eng. processes

- Study the main domains and applications of optimization methods in the context of Digital Automation Engineering

- Become familiar with formal mathematical modelling

- Develop simple optimization methods in Python

- Move from the domain of Optimization to that of Discrete Event Simulation

- Study how these methods can be embedded into Decision Support Systems to be fully usable in practice

- Provide a path forward more elaborated applications

Exams

The exam comprises both practical and theoretical evaluations

Part\Type of exam	Practice	Theory
Optimization	Exam 1 (25%)	Exam 3 (50%)
Simulation	Exam 2 (25%)	

Exam 1 (optimization practice): a student project, to be developed in group during the lectures, in which in solving an optimization problem through a **Python** code

Exam 2 (simulation practice): a student project, to be developed in group during the lectures, consisting in solving a simulation problem through the **Anylogic** software

Exam 3 (theory): final written examination on all the course program.