Title: Control methods for distributed optimization

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Abstract
This course explores the connections between control and optimization methodologies, focusing on the analysis of optimization algorithms as feedback interconnected dynamical systems. It covers both basic and advanced topics in these disciplines, enabling students to understand the deep connections between the two areas. Through selected practical examples and exercises, theoretical concepts - such as algorithm convergence and stability analysis - will be illustrated to demonstrate the potential impact of these connections.

Objectives
The course objectives are:

- Illustrate the state of the art about distributed optimization algorithms.
- Show the interconnection between optimization and control in the study of optimization algorithms.
- Familiarize with theoretical convergence proofs/stability analyses of algorithms.
- See innovative, research-oriented perspectives to distributed optimization.

Topics
The course is organized into 90-minute lectures, as follows:

Thu-M1: Basics in optimization and operator theory

Thu-M2: Linear averaging and distributed algorithms

Thu-A1: Basics in passivity theory

Thu-A2: Distributed consensus optimization

Fri-M1: The gradient method analysis under the lens of control theory

Fri-M2: The integral action applied to optimization and network problems

Fri-A1: ADMM for constrained optimization via operator theory

Fri-A2: Distributed ADMM for constraint-coupled optimization

Sat-M1: Distributed consensus optimization via control theory

Sat-M2: ADMM fo constraint-coupled optimization via control theory.