OPTIMIZATION METHODS AND OPTIMAL CONTROL

Course Workload		Assessment form (examination/ graded test/ ungraded test)
ECTS	Hours	
3	108	Ungraded test

Discipline deals with optimal control design for dynamical systems or plants described by differential equations.

Course structure:

1. STATIC OPTIMIZATION
   - 1.1. Necessary and sufficient conditions for function extrema.
   - 1.2. Method of Lagrange multipliers.
   - 1.3. Methods of static optimization.
   - 1.4. Kuhn–Tucker conditions.

2. OPTIMAL CONTROL PROBLEM STATEMENT
   - 2.1. The problem of optimal control. Formulation. Examples.
   - 2.2. Classical cost function in the Lagrange, Bolza, and Mayer forms.
   - 2.3. The definitions of the Lagrangian and Hamiltonian.

3. CALCULUS OF VARIATIONS
   - 3.1. Euler–Lagrange equation.
   - 3.2. Linear quadratic regulator.

4. PONTRYAGIN'S MAXIMUM PRINCIPLE
   - 4.1. The problems with fixed state and time points.
   - 4.2. The problem with free state points and fixed time.
   - 4.3. Transversality conditions.
   - 4.4. Legendre condition.

5. DYNAMIC PROGRAMMING
   - 5.1. Bellman’s Principle of Optimality.
   - 5.2. Hamilton-Jacobi-Bellman Equation.
   - 5.3. Optimal Control of a Discrete System.

6. KALMAN FILTER

- 6.1. Optimal State Estimation.
- 6.2. Kalman-Bucy Filter.

7. H∞-CONTROL

- 7.1. H∞-norm.
- 7.2. H∞-controller design.