ITMO University

Actuators Control

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

The objective of this course is to discuss some of the drive systems based on electrically powered actuators in common use. The course contains the basic principles of the theory of the electric motor and drive, its mechanics, properties and static characteristics of the main types of electric motors, their operating modes, dynamics, as well as the main methods of modern electric drives' control. The course describes the basics of the theory of electrically powered actuators, mathematical models of various motors, including in a vector representation, as well as the principles of design, analysis and synthesis of modern open-loop and closed-loop drive systems. On the labs, the students will work in MATLAB to design models electrical machines and drives.

Course structure:

0. Introduction in Electrically powered actuators. Basic concepts

0.1. Drive systems' classification. Electric drive and its parts. Electric drive application.
0.2. Design schemes of the mechanical part of the electric drive for modeling and analysis
0.3. Two-mass mechanism
0.4. Static characteristics of electric drive.

1. Common questions of the coordinates' tuning method of the electric drive

1.1. Open loop control system on example of a generalized motor with linear speed torque characteristic
1.2. Static characteristics of closed-loop systems
1.3. Dynamic characteristics of closed-loop systems
1.4. Tuning of cascade control system of the motor

2. DC motor with cascade control strategy

2.1. Mathematical model and steady state characteristics of direct current (DC) motors
2.2. Current/torque control loop's tuning of direct current (DC) motors
2.3. Speed control loop's tuning of direct current (DC) motors

2.4. Position control loop's tuning of direct current (DC) motors

3. Basic theory of AC electrical machines and description of processes in them using generalized vectors

3.1. Basic theory of AC electrical machines

3.2. Complex vector. Reference frame transformation by complex vector. Mathematical model of generalized electrical machines

4. Vector and scalar control of induction motor

4.1. Basics of Induction motor. Steady state characteristics of induction motors. Scalar control of induction motor

4.2. Vector control of induction motors

5. Vector and scalar control of synchronous motor

5.1. Basics of synchronous motor. Steady state characteristics of synchronous motor

5.2. Vector control of synchronous motor