

SENSORLESS CONTROL

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

The discipline "Sensorless control" is devoted to methods of synthesis of adaptive observers of state variables and parameters and algorithms of sensorless control for electromechanical systems. The course includes the principles of modeling of electromechanical systems such as synchronous motors, the basic principles of vector control of AC motors, the study of adaptive observers and sensorless controllers. Nonlinear parameterization of the mathematical model of a synchronous motor, signal filtering techniques, a standard gradient descent-based estimator and a dynamic regressor extension and mixing algorithm are used to construct adaptive state variable observers. Completing practical tasks students acquire skills in construction of models of electromechanical systems, adaptive observers and sensorless controllers in the MATLAB Simulink environment.

Course structure:

1. ANALYSIS OF MATHEMATICAL MODELS OF ELECTROMECHANICAL SYSTEMS AND SYNTHESIS OF REGULATORS

- 1.1. Electromechanical systems. AC motor design.
- 1.2. Mathematical model of a synchronous motor.
- 1.3. Park and Clarke transformations.
- 1.4. Vector control method.

2. DESIGN OF ADAPTIVE OBSERVERS AND SENSORLESS CONTROL ALGORITHMS

- 2.1. Methods for the synthesis of adaptive and robust observers for electromechanical systems.
- 2.2. Gradient parameter estimation method.
- 2.3. Dynamic regressor extension and mixing method.
- 2.4. Asymptotic and exponential convergence of observers.
- 2.5. Sensorless control methods for electromechanical systems.