Course Syllabus

1. Course Title:

Modeling of Control Systems

2. Academic Level:

Bachelor

3. ECTS Credits:

6 ECTS

4. Semester:

4, spring semester; 5, autumn semester

5. School/Department:

Institute of Radio Engineering Systems and Control/ Department of Automatic Control Systems

6. Location:

Taganrog Campus, 44 Nekrasovsky Lane, Taganrog

7. Instructor:

Assoc. Prof. Valentina Shadrina, email: vvshadrina@sfedu.ru
Assoc. Prof. Elena Shestova, email: eashestova@sfedu.ru

8. Language of Instruction:

English

9. Course Description:

The discipline Modeling of control systems considers methods of mathematical modeling of complex dynamic objects and control systems, as well as types of mathematical models of objects and control processes. Students get acquainted with the basic principles of designing and investigating mathematical models for the optimization and control of technical objects, including the use of fuzzy logic methods. Practical exercises and laboratory work are supported by many examples, allowing students to study in more detail the process of modeling control systems using modern application software packages.

10. Course Aims:

Course aims: to study the methods of mathematical modelling of complex dynamic objects and control systems, types of mathematical models of control objects and processes, methods of construction and research of mathematical models for optimization and control of technical objects, including the use of modern methods of fuzzy logic.

11. Specific entry requirements (if any):

-

12. Course Content:

Term 4
Section 1: Classical method for solving differential equations
Section 2: Operator method for solving differential equations
Section 3: Simulink exponential processes
Section 4: SimInTech: Fluid escaping from a vessel
Section 5: CMOS in Simulink
Section 6: Damped pendulum oscillation model
Section 7: Theory of finite and probabilistic automata

Term 5
Section 1: Fundamentals of Set Theory.
Section 2: Fundamentals of fuzzy logic.

13. Intended Learning Outcomes:

After studying this course, the student will receive the following knowledge, skills and abilities.
Knowledge: basic principles and methods for formalizing, constructing and investigating mathematical models of control systems, their forms of representation and transformation for control purposes; the tools for designing and assessing the effectiveness of management systems developed on the basis of mathematical methods; models and methods of mathematical modelling of complex dynamic objects and control systems; methods of formalizing the parameters of technical systems in conditions of incomplete initial data, at the verbal level using expert knowledge; artificial intelligence methods in managing complex technical objects.
Skills: to apply the principles and methods of model building; use the principles and methods of mathematical modelling in the development and research of control systems; to build control systems based on mathematical methods; to carry out experiments according to set methods and process the results using modern information technology and technical means; to apply intelligent methods for modeling control systems for technical objects.
Abilities: master the principles and methods of modelling automation, control and management systems and tools; use modern software tools to create, transform and investigate control system models; use methods to build mathematical models of management systems, to assess their effectiveness; own standard application software packages for solving practical problems of managing technical objects using intelligent technologies.

14. Learning and Teaching Methods:

Lecture - visualization using presentation material.
Practical classes - consideration of various examples of construction and study of mathematical models for optimization and control problems of technical objects.
Laboratory classes - are backed up with many examples to allow students to learn more about modeling of control systems.
Self-study - use of different reference books and Internet resources.

15. Methods of Assessment/Final assessment information:

Current assessment: Performing laboratory work, a written survey, an essay.
Frontier assessment: written assignment.
Final assessment: 4 term – offset; 5 term - exam

16. Reading List:

Main reading list.

1. Soloviev V.V., Shadrina V.V., Shestova E.A. The Basics of the fuzzy modelling in Matlab: tutorial. - Taganrog: SFU Publishing House, 2015. — 99 p. ISBN 978-5-9275-1683-4. URL: https://biblioclub.ru/index.php?page=book&id=462029.

2. Soloviev V.V., Shadrina V.V., Shestova E.A. Investigation of the fuzzy control systems in Matlab: tutorial. - Taganrog: SFU Publishing House, 2015. — 54 p. ISBN 978-5-9275-1686-5. URL: https://biblioclub.ru/index.php?page=book&id=462028.

3. Intelligent information systems and technologies / Yu.Yu. Gromov - Tambov: Publishing house of Federal State Budgetary Educational Institution of Higher Professional Education "TSTU", 2013. - 244 c. http://biblioclub.ru/index.php?page=book&id=277713

4. Andreychikov, A.V. Intelligent Information Systems and Methods of Artificial Intelligence: Textbook / A.V. Andreychikov, O.N. Andreychikova. - Moscow : INFRA-M, 2021. - — 530 c. + Extras [Electronic resource]. - (Higher Education: Master's programme). - DOI 10.12737/1009595. - ISBN 978-5-16-014883-0. - Text : electronic. - URL: https://znanium.com/catalog/product/1009595.

Additional reading list.

1. Intelligent systems: textbook / A. Semenov, N. Solovyov, E. Chernoprudova, A. Tsygankov; Orenburg State University. - Orenburg: Orenburg State University, 2013. - 236 p. – Access mode: URL: https://biblioclub.ru/index.php?page=book&id=259148.