



CS216

WORKSHOP IN MODELING

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ANNOTATION

The aim of the course is to acquaint students with basic concepts, mathematical principles, approaches and modern trends in modeling real processes. The course introduces functions and features of the mathematical software package MATLAB, such as: operations with matrices and vectors, differential equations, statistical tools, graphical representation of data in various forms and video animations of spatio-temporal data. Neural networks, fuzzy logic and genetic algorithms are considered, as well as generalized networks (GNETs) as extensions of Petri nets .

Students create models of various processes.

MAIN OBJECTIVES

The purpose of this course is to demonstrate the use of computer modeling to explore and solve a variety of problems with a variety of modeling tools. The first module of the course introduces the MatLab programming environment and its application in modeling. Students learn:

- to apply models of various processes and systems and to document the results, Yes they use MATLAB like means for solving on different scientific problems and as an integrated programming environment.

In the second module of the course, students are introduced to basic elements of the theory of different classes of Petri nets , emphasizing Generalized Networks (GNETs) and ways to model real processes with them. Specifically, the students must:

- to understand the essence of the basic concepts in the theory of OM and explore the mechanism of functioning of a given one OM;
- construct OM based on given information about a real process and acquire skills for modeling a set of parallel running real processes through OM,

PREREQUISITES

Knowledge of Mathematics I and II part is required for the correct learning of the course.

STATUTE AND STRUCTURE

| specialty | status | Loans | regular training | | | | distance learning | | | |
|-----------|------------|-------|------------------|------|---|------|-------------------|-----|---|------|
| | | | I | with | U | comm | I | wit | U | comm |
| ICN | Mandato ry | 3 | | 30 | | 30 | | 15 | | 15 |
| PIM | Mandato ry | 3 | | 30 | | 30 | | 15 | | 15 |
| SI | Mandato ry | 3 | | 30 | | 30 | | 15 | | 15 |

COURSE CONTENT

Topic 1. Introduction to computer-based modeling by means of the MatLab program environment.

Topic 2. Introduction to MatLab: constants and variables, special symbols, scalars, vectors and arrays, operations. Charts.

Topic 3. Inverse matrix, determinants, systems of equations, complex numbers, polynomials. Topic 4. Statistical functions. MatLab files. Iterations.

Topic 5. Introduction to neural networks and fuzzy logic.

Topic 6. Introduction to fuzzy mapping .

Topic 7. Introduction to evolutionary calculations.

Creation of a program to solve a specific problem and an individual report of the results.

Topic 8. Definitions and basic properties of the Petri net and the OM. Reduced OM.

Topic 9. Extensions of OM. Intuitionistic Fuzzy OM. Colored OMs. OM with global memory. OM with emergency clock. OM with optimization components. OM with a complex type of transitions. OM with stop conditions. OMs with cores that can accept feature variables.

Topic 9. Graphic representation of a transition in OM. A formal description of a transition. Formal description of OM. A general algorithm for the operation of a transition at a certain point in time.

Topic 10. Applications of OM in informatics and industry.

COURSE ASSIGNMENT .

The best term papers, translated into English and formatted according to the relevant standard, will be offered for publication in journals. The criteria for evaluating the development are:

- Originality of the topic.
- Project description - complete and true•
Formation of the article.
- Presentation of the project (defense). The defense takes place at the end of the semester.

EVALUATION METHODS

To form the grade, the student collects points, the maximum value of which is 100.

The distribution of points for the evaluated activities is as follows:

| | |
|--|-----------|
| 1. Auditor employment | 34 points |
| 1.1. Current control of control tests | - 14 |
| 1.2. Visits, control work, participation, independent work, etc. - | 20. |

2. Outside classroom employment12 points

2.1. Course assignments, term papers, projects, protocols and etc. - 12 points

3. Examination procedure.....54 points

The overall grade is determined by the sum of the points during the semester and by the examination procedure: 36-50 points. - Middle 3); 51-65 items – Good (4); 66-80 t.–Pl. Good(5); Over 81 points – Excellent (6). The student must have a minimum of 14 points from the control during the semester and a minimum of 22 points from the examination procedure in order to form a complex evaluation.

RECOMMENDED LITERATURE

1. Georgieva, P. , Constructing an optimal portfolio with a genetic algorithm. 2017
2. Ivanov, Ivelin; Vanteva , Violeta; Georgieva, Penka V, Recognition on persons from a real-time video stream. *COMPUTER SCIENCES AND COMMUNICATIONS*,6,1,69-98,2017
3. Hasanov, Hasan; Georgieva, Penka V, Voice recognition - historical development and basic techniques. *COMPUTER SCIENCES AND COMMUNICATIONS*,6,1,20-55,2017
4. Nikolova, Stefani; Georgieva, Penka V , Fractal patterns in biology. *COMPUTER SCIENCES AND COMMUNICATIONS*,6,1,56-68,2017
5. Garipova , Julia; Georgieva, Penka; Georgiev, Anton ,Empirical Bayesian estimates of operational reliability related to electronic items for medical Purpose, *Physics-Eternally Young Science*, 2018
6. Georgieva, Penka V; ,Genetic Fuzzy System for Financial Management, *Cybernetics and Information Technologies*,18,2,20-35,2018, Sciendo
7. Mollova , S; Zhekov , M; Kostadinov, A; Georgieva, P,Laboratory model for research on computer cluster systems,"2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)", 1388-1393,2018,IEEE
8. Ivanov, Alexander; Georgieva, Penka , Convolutional Classification Neural Networks. *COMPUTER SCIENCES AND COMMUNICATIONS*,7,1,46-52,2018
9. Georgieva, Penka; Popchev , Ivan , Rule - based optimization with a genetic fuzzy system . *COMPUTER SCIENCES AND COMMUNICATIONS*,7,1,132-139,2018
10. Mollova, Stoyanka; Georgieva, Penka; Kostadinov, Atanas , Fault-tolerance of a Laboratory Computer Cluster, 2018 20th International Symposium on Electrical Apparatus and Technologies (SIELA), 1-4, 2018, IEEE
11. Georgieva, Penka; ,Parameters of GFSSAM: coding the parameters of a hybrid genetic fuzzy system,Proceedings of the Seventh International Conference on Telecommunications and Remote Sensing , 85-92, 2018, ACM
12. Castillo O.; P. Melin, Hybrid Intelligent Systems for Pattern Recognition Using Soft Computing: An Evolutionary Approach for Neural Networks and Fuzzy Systems.: Springer, 2005.
13. Fakhreddine O., Cl. De Silva, Soft Computing and Intelligent Systems Design.: Addison Wesley, 2004.
14. Hoffmann F., M. Köppen, F. Klawonn, R. Roy, Soft Computing: Methodologies and Applications. Series: Advances in Soft Computing: Vol. 32, 2005
15. Atanassov K. Generalized Nets in Artificial Intelligence. Vol. 1: Generalized nets and Expert Systems, Ibid., 1998.
16. Atanassov K., H. Aladjov Generalized Nets in Artificial Intelligence. Vol. 2: Generalized nets and Machine Learning, Ibid., 2000.