Application of information technologies when training in the master’s degree program

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Abstract. This article considers the use of computer technologies in teaching applied mathematics in Moscow Aviation Institute (for master’s degree program). We provide the list of disciplines, which reflect the specificity of training directions. The possibilities of forming extension packages for computer modeling systems are discussed. Much attention is paid to developing the skills of independent work in the learning process. Attention is drawn to the use of intelligent training simulators, web technologies and expert systems for distance learning.

1. Master’s programs
During formation of curricula for master’s program in Moscow Aviation Institute (MAI) at Mathematics and Cybernetics department in the "Information Technologies in Control" speciality rather large amount of mathematical disciplines is provided. In the majority, these disciplines have application-oriented character and display specifics of preparation directions.

In learning process a great variety of subjects is available: «Modern optimal control theory», «Computational linguistics and information technologies», «Numerical methods for the solution of engineering problems in computer algebra systems», «Intelligent systems», «Information technologies», «Application of global optimization methods in control», «Methods for the solution of information processing problems», «Optimization of hybrid control systems», «Analysis and synthesis of nonlinear stochastic systems and its application in aeronautical engineering and economics», «Languages and technologies of information interchange», «Computer methods in control theory problems».

Due to the limitation on teaching time for all disciplines, independent work of undergraduate students plays an important role. For the organization of student independent work it is necessary to formulate tasks, to specify literature (which is necessary for a study) or websites (which contain necessary educational and methodical materials). In the course of studying an undergraduate usually communicates with teacher by e-mail. «Rating» system is used for the assessment of students of master’s degree program. Task solution procedure and communication activity (on condition of correct task solution) is often treated as a reason for positive grade.

2. Using information technologies in training process
Owing to the development of information technologies there is an opportunity to simplify the procedure of laboratory and course tasks generation and its validation (that can be done via the Internet). Systems of computer simulation (SCS) (e.g. MLSY_SM, Spektr_SM + Simulink + Matlab, Spektr_SM + VisSim + Mathcad) are widely used for the solution of tasks of control systems analysis and synthesis. The development technology of extension modules of SKM is studied. Using
previously mentioned technology students develop software modules for described earlier packages during academic year projects [1, 2]. An illustrative block diagram of the structure of the online learning system in the Master's program "Information Technologies in Control" is shown in figure 1.

Figure 1. The structure of the online learning system in the master’s program "Information Technologies in Control".
Intelligent learning exercise machines are widely used in educational process. They are based on semantic models of objects. Their use allows improving skills of the standard tasks solution. It is very important to include in educational process rather short videos (with duration of 5-15 minutes) for visual demonstration of questions, which are essential for understanding.

For teaching of masters at Mathematics and Cybernetics department of MAI the special computer educational and methodical complexes, which include theory-reference, question-explanatory and problem and algorithmic modules (that allow teaching how to solve standard and specialized tasks), are created. In addition, they can be used to complete course works.

Web technologies and expert systems are more and more frequently used in learning process. They allow individualizing educational process for the listeners, who are not located within the university territory. The training in the web conference mode allows teacher to show task solution by the means of virtual board. At the same time, it is possible to control the decision of the similar task for each trainee. The system of online training, which is used at department, incorporates function of the step-by-step task solution for different disciplines (including mathematical) in real time [3, 4].

3. Computer technologies and software tools
During training undergraduates get acquainted with the new directions of computer technologies: features of the modern SQL and NoSQL of the DBMS, languages and technologies of information exchange on the basis of XML technologies, the intellectual analysis of "big data" on the basis of Data mining and Machine Learning algorithms, computational linguistics. In addition, students acquire skills in fields of information technologies of decision-making, principles of the symmetric and asymmetrical encoding, skills of operation with digital signatures, validating practical and term papers in a paperless format.

Considerable value during training is acquisition by undergraduates of practical skills of operation with instrumental software, such as database management systems, XML editors, programs and the environments of data analysis (e.g. Weka, RapidMiner, MS Azure Machine Learning Studio), cryptoproviders and the program of signing/encoding (figure 2).

![Software tools diagram](image)

**Figure 2.** Structural diagram of the software tools.
The course "Computational Linguistics and information technologies" introduces the fundamental linguistic concepts, traditional principles of research speech and language, and modern methods of automatic processing of natural language texts.

Particular emphasis is done on the research of semantic structures of texts and automatic semantic text processing. Solution of problems of analysis and synthesis of natural-language text are discussed in the context of object-oriented modeling and design of basic procedures and language modules of automatic text processing systems (machine translation, search and analytical systems, etc.).

Application of computer technology in the training process is performed via the use of the own linguistic platform "Metafraz" as an educational tool. The platform "Metafraz" is based on the theoretical concept of phraseological conceptual analysis of different texts and provides the complete technological cycle of texts conversion into the formal semantic representation.

This linguistic software is designed as an unified integrated multifunctional software, which consists of several subsystems that are intended to solve individual problems of processing, formalizing, translating and analyzing the semantic content of multilingual documents [5].

Applied computer technologies allow making learning in a master’s degree program really modern and organize individual training process with an opportunity to control, monitor and sum up.

References

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