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A MODERN VISION OF THE APPLICATION OF GEOMETRIC MODELING METHODS IN THE REMOTE FORM OF EDUCATIONAL

Lebedieva Olha, senior lecturer
meganom8@ukr.net, ORCID: 0000-0003-1569-5987
Nadkernychma Tetiana
t_nadker@ukr.net, ORCID: 0000-0002-9147-0512
Nor Oleksandr, student gr. ОФ-41мп,
nor.oleksandr@lll.kpi.ua
National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute" (Ukraine, Kyiv)

Abstract *– the article discusses the current situation and prospects for the use of software products in distance, asynchronous and blended learning in higher education institutions, in particular in the field of mechanical engineering. The emphasis is placed on the peculiarities of perception when using multimedia tools, their disadvantages and advantages from the point of view of specialists from different countries*

Keywords *– distance learning, asynchronous learning, perception, multimedia, animated geometric modelling, software for geometric modelling*

Problem Statement. The Covid-19 pandemic and the military invasion of Ukraine have led to a change in the organisation of the educational process in higher education institutions and led to an urgent transition from traditional full-time education to distance learning in synchronous, asynchronous or mixed forms.

In this regard, there is a need to find new approaches and methods in teaching technical disciplines, select and improve innovative technologies for use in distance learning in higher education institutions that would ensure high quality training.

Analysis of Recent Research. In the opinion of Ovsyannikova V. V. (2016), the existing experience of using the newest technologies in higher technical education in the online format shows that they are sufficiently effective and have broad prospects for development and application. In addition, it can be reasonably predicted that even after the circumstances of forced use of distance learning are eliminated, such education will be in demand, as its advantages have become apparent: visibility, convenience, accessibility, the ability to choose the schedule and form of education or work.

According to the theory of multimedia learning developed by psychologist Richard E. Meyer (2001), optimal perception is achieved when verbal and visual materials are synchronised in time. Such conditions in the presentation of educational materials and in the development of new devices may be achieved by using animated geometric modelling with appropriate text or voice commentary.

With Clark, Ruth Colvin (2003) delve deeper into the study of perception issues in e-learning and develop recommendations for software developers.

Grabchenko A.I., Dobroskok V.L. (2009) devoted much attention to the mathematical apparatus of 3D modelling for solving problems of computer-aided industrial design (design). The use of computer modelling enables us to see an object that does not yet exist, obtain its geometric characteristics, study its physical properties by setting up numerical experiments, make the necessary changes, prepare production and, finally, manufacture the object. CAD/CAM/CAE systems serve as a tool for solving these tasks. One of the elements of such systems is a mathematical model of the geometry of the designed object.

Romanko I. I. (2021) analysed the didactic problems and prospects of using information technologies in education. According to Romanko I. I. (2021), informatisation of education will ensure the transition from illustrative and explanatory teaching methods and mechanical assimilation of factual knowledge to mastering the ability to independently acquire new knowledge using modern methods of information presentation, means of information interaction with objects of the subject environment created on the basis of multimedia technologies, "virtual reality", using the capabilities of peripheral equipment of modern computing.

Formulation of Goals (Task Setting). The purpose of this article is to demonstrate some approaches to the use of multimedia in higher education institutions in teaching engineering disciplines.

Main Part. Geometric modelling is considered as a branch of mathematical modelling that includes the description of geometric images and the performance of certain operations on them in two-dimensional, three-dimensional or multidimensional space.

The theoretical basis of geometric modelling is differential and analytical geometry, topology and branches of computational mathematics. Geometric modelling studies methods of constructing curved lines, surfaces and solids, methods of performing various operations on them various operations and methods of managing numerical models.

For example, G. Raikovska (2018) interprets geometric modelling as "a set of operations and procedures that include the formation of a geometric model of an object and its transformation in order to obtain the desired image of the object and determine its geometric properties".

According to Boyko V.A. (2015), geometric modelling is a basic function of engineering and design practice, which is widely used in professional design and development activities and in the system of professional training of engineering and technical specialists. At the present stage of development, this type of modelling involves the necessarily use of computer modelling.

Raikovska H. O. (2018) concludes that the formation of metalworking machines today puts forward a lot of fundamental questions to the designer. The clarity and simplicity of the forms are intended to optimise the working conditions and use modern technology of machine tools production.

The main conditions for the rational ergonomic design of products in the machine-building industry include the necessary consideration of the specific components of the human-technology-environment system that manifest themselves in the functioning of the product. These features include: the type of product and its operation; the characteristics of the human body; and environmental conditions. However, for the large majority of consumers, the ergonomics of any product is easily determined.

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Polischuk, M.M., Tkach M.M. (2021) presented the history of CAD systems, the main functions of CAD/CAM/CAE systems, as well as the Architecture and principles of CAD construction and Structural subsystems in an expanded manner.

The list of CAD systems is quite numerous and is constantly being enriched by new applications.

The most famous are the following:

- SolidWorks: 3D modelling and creation of associative drawings, a system for engineering calculations SolidWorks Simulation (strength calculations, etc.), SolidWorks Motion (kinematics and dynamics of technical systems), CAMWorks module for SolidWorks (creation of programmes for computer numerically controlled machines), and Intermech (design and technological preparation of production - Cadmech and Techcard).

- AutoCAD is a two- and three-dimensional computer-aided design and drawing system that includes a full set of tools for complex three-dimensional modelling (solid, surface and polygonal modelling is supported). AutoCAD allows you to get high-quality visualisation of models using mental ray rendering.

The programme also implements 3D printing management (the modelling result can be sent to a 3D printer) and support for point clouds (allows you to work with 3D scanning results). However, it should be noted that the lack of three-dimensional parameterisation does not allow AutoCAD to compete directly with engineering CAD systems such as Inventor, SolidWorks and others.

- Inventor (Autodesk) 3D CAD software for creating and studying the behaviour of digital prototypes of products and parts. Developed by Autodesk. Created for 3D design of mechanics, product emulation, and toolkit creation.

Conclusions. As practice has shown, the use of computer geometric modelling in CAD systems allows us to organise a number of training courses at a qualitatively new, modern level to organise a number of training courses in professional training in the the field of mechanical engineering.

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