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SECURITY SYSTEMS: CASE OF THE CAD PROGRAM FOR CREATING 3D MODELS

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Abstract. The article describes an implementation of CAD program T-Flex for creating 3D models in scientific research at the University of Security Management in Košice. Benefits of using this program in an individual course of the study programme Management of Security Systems will be explained in this article. T-Flex program would allow the students to design and subsequently model the security systems. The acquired knowledge and skills of students in the program T-Flex can be used in their participation in research activities through diploma theses, bachelor theses, semester project, as a benefit for their future application in practice. The implementation of the individual subject using the T-Flex program together with mutual links with other courses within the study programme Management of Security Systems would result in an increase attractiveness and effectiveness.

Keywords: security systems, 3D modelling, program T-Flex, scientific research

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1. Introduction

In addressing the challenges and problems associated with civil security within security education of students it is important for a researcher to focus on technical matters as well, bringing space and imagination into them. These skills and abilities represent a solid and logical basis for technical studies of security systems. Currently, designing and modelling of security systems using two-dimensional drawing programs have gradually been replaced by a new generation of programs, a new way of designing, represented by parametric modelling in 3D. A fully functional program, enabling professional creation of parametric 3D models of security systems, is T-Flex CAD program.

The quality and content of higher education is currently a frequently discussed issue in society. For students, university is not only a source of information and knowledge, but through university teachers provides them with skills and treatment of theoretical methods that help students classify, process and adequately apply in an effective manner the acquired information in practice. In order to meet the main objective of university study, namely the real usability of the acquired knowledge in practice, there should be a change in course content. Durability of the acquired knowledge is affected by various factors and, in certain circumstances it may be extended. Only the acquired information, which has previously been sufficiently understood by the student

and processed in his consciousness, can become student's permanent property. In an effort to educate as many graduates as possible to approach the ideal graduate profile it is necessary that the learning process was optimal, rational and efficient. The teaching process has its own set of goals that must be achieved in due time. This is associated with the energy expended by both the teacher and the student, from which then arise adequate results of teaching activities in relation to time and energy. To make the learning process effective and meet its objectives, the teacher must use teaching methods, material resources, apply the principles of teaching, create organizational forms and, finally, apply interdisciplinary relations, as the acquired knowledge is without connections and contexts fragmented (Vacková, at. al., 2016).

In the present time, it is very common to use Electronical Education at High schools and at the Universities of all types (Drotárová, at. al., 2016). The aim of this article is to point out the adequacy of using the T-Flex CAD in the teaching of the subjects at the University of Security Management in Košice, as this way students may acquire the skills reflecting the requirements of modern times, the use of computer technology in practice.

The next aim is designing 3D models of security assemblies in the T-Flex CAD program that can help students in subjects such as Elasticity and Strength, Statics, Basics of Mechanical Engineering, Fundamentals of Structural Engineering, Descriptive Geometry, which are taught in the Management of Security Systems study programme at the University of Security Management in Košice. These subjects are based on natural laws and allow the development of analytical and logical thinking necessary for understanding of other technical and science subjects. They are a solid and logical basis of security systems technical studies.

New quality and higher efficiency of designing security systems comes in the form of designing and manufacturing assisted by computer technology. Capturing the new trends in vocational schools is important from the point of view of preparing students to use computer technology in practice. The requirements put on teachers are thus high due to the combination of 2 aspects of human activity. They are designing, calculating and controlling of components, mechanisms and complete machines on one hand and drawing using computer technology on the other (Kováčová and Klimo, 2013).

Constantly changing social needs, but also the continuous development of science and technology, with which it is most closely related to the emergence of new security risks and threats dynamically affect the entire education system (Kavan, at.al., 2015; Tvaronavičienė et al., 2015; Branten, Purju 2015; Matetskaya, 2015). The role of the learning process is not just verbal learning of the curriculum, but also learning about real relationships, students learn to understand, be able to apply such knowledge, analyse it, synthesize, evaluate and predict. Equally can be understood the role of the teaching process in security education. Graduates of the study programme Management of Security Systems are able to succeed on the labour market in all sectors of security at various stages of management. The security issue of an organization is interdisciplinary matter. When we talk about the security of the organization we mean the implementation of permanent set of security measures which are used for the protection of people in the organization and all tangible and intangible assets related to its business (Lošonczi and Bruna, 2011; Samašonok et al., 2016; Raudeliūnienė et al. 2016; Laužikas et al. 2015).

The goal of safety education is to prepare a security group of experts for the management of institutions of different sizes and varying degrees of complexity (Kavan, 2015). Security education at the University of Security Management in Košice focuses on the development of students' knowledge and skills linked with security, increasing the qualifications and expertise of graduates, preparing them to deal with risk, emergency and crisis phenomena in various fields of security (civil, economic, environmental, technical and technological, logistical, etc.). This is possible due to a wide range of subjects that help produce a graduate with profound knowledge of these areas of security. One of these areas is a technical area where students acquire technical knowledge, the ability to apply security aspects of management in relation to technological and technical problems, to manage the operation of technical systems in manufacturing and business companies. The student is able to perform the profession of security technician with the focus on manufacturing and operational processes of selected industries and services, apply himself/herself as an engineer in the areas requiring the technical scope of knowledge and creativity in general, the ability to make decisions and solve technical and managerial problems (Prada, at. al., 2013).

Currently, there are a large number of software packages that are very useful not only in the planning process but also in designing, constructing and, finally, in analysing security systems. It is the involvement of computer support in the process of designing which allows us to take advantage of new progressive technologies and methodologies to achieve the desired goal. This lies in creating a sophisticated security system in its substance interesting not only for its very specific applications but for its more massive application as well. Finally, using appropriate software tools it is possible to achieve this way significant savings in funds earmarked for the implementation of the project. Specific funds can be saved by the appropriate technical analysis of the characteristics of the given device such as a simulation of mechanical load, depreciation, verification of the dynamic properties as well as reliability in a particular environment. Simulating the effects of various fields, loads and dynamic influences we can get some idea about the behaviour of the device in a specific situation. This allows us to predict the possible behaviour of the device in a certain time frame in which it will actively be used (Prada, et. al., 2013).

2. Characteristics of the T-Flex program

T-Flex is a new 3D CAD system affordable on the Czech and Slovak market. T-Flex CAD is a fully functional program that enables the professional creation of parametric 3D models, including the creation of spaces and drawings. In the Czech Republic, the program is distributed by SoliCAD, Ltd.

T-Flex is a top comprehensive CAD/CAM/CAE/PDM system designed especially for professional work. The T-Flex system is built on the basis of fully cooperating models whose common denominator is a parametric and surfacing modeller, T-Flex CAD. With the T-Flex program ideas can be effectively transferred to the stage of production documentation. The T-Flex contains a wide range of highly innovative parametric modelling tools that allow designers to quickly create basic elements simply by adding conventional forms – holes, rounding, chamfering or a more complex geometry – deflections, parametric curves, screw shapes, etc.

T-Flex is a product of the Russian company Top Systems, which has been developing the program since 1989. That year it was founded by seven graduates of the Moscow Technical University, near where the company resides till today. T-Flex software is made up of several parts, as follows – T-Flex CAD – basic 3D CAD program, T - Flex Analysis – supplement for T-Flex CAD, T - Flex Dynamics – supplement for T-Flex CAD, T-Flex Technical Support – technical support, including updates.

T-Flex Analysis offers a wide range of specialized analysis tools that help users to virtually test and analyse complex assemblies by using the finite element method for the design of static, frequency, buckling, thermal, fatigue and other analyses and optimizations. T-Flex Analysis shows how the design will behave in real life conditions before it is made. Users of T-Flex Analysis can carry out the analysis of structures, simulation and optimization directly in a T-Flex. Quick and efficient analysis often reveals hidden solutions and helps users to better understand the nature of the product. Whether it is used in mechanical, electrical, aerospace, transport, energy, medical or construction industries, T-Flex Analysis can help shorten development time, reduce the cost of testing, improve product quality, and speed up market.

Static analysis options allow the users of the program to perform the analysis of voltage parts and assemblies with varying load. Static studies calculate displacements, reaction forces, deformation, stress and distribution of safety factors. Static analysis can help in avoiding a rupture caused by high stress. Different ways of loading and boundary conditions can be defined, including force, pressure, tension, centrifugal forces, lifting capacity, moments, prescribed displacements, temperatures, etc.

Frequency analysis determines the natural frequencies and mode shape of components. It can determine whether the component will resonate at the frequency of the connected-driven devices, e.g. engine. Typical are the designs of speakers, aircraft structures, bridges, construction equipment, analysis of robotic systems and other devices.

The analysis of critical load with respect to buckling verifies the geometric stability of the model, notably under axial load. It helps to avoid the loss of stability that results in sudden large deformations, which in normal use

of the products can be catastrophic. Buckling analysis detects the ultimate load for buckling and is commonly used in the construction of car frames, columns, foundations, structures, electrical poles, determination of safety coefficients, etc.

Repeated loading and unloading weakens constructions over time, even if the induced voltages are considerably smaller than the allowed limit load. Fatigue analysis is essential for products such as steel structures or beams, which may mechanically fail under cyclic or other load that never reaches values sufficient for breaking the single load. T-Flex analysis simulates fatigue failure and the application of cyclic loading allows determining the fatigue strength to design product life cycle and thus ensure the safety of the operation.

T-Flex Dynamics – is a versatile add-on application for simulating the movement, which is used to study the physical behaviour of the design without leaving the T- Flex CAD environment. T-Flex Dynamics software is used for virtual prototyping. It assures its user that his designs will work before he builds them (Klimo, at. al., 2013).

3. Creating 3D models using T-Flex CAD program

Currently, it is common that technical documentation is fabricated by means of computer technology, and mainly 2D programs are used. A three-dimensional model arises in the minds of designers and a two-dimensional view of the model or its cross-section gets displayed on the screen. This approach is typical for technical and vocational education. However, within a few years 2D programs will be less used and companies will prefer a new generation of programs, and a new method of designing, parametric modelling in 3D. This parametric 3D modelling is possible due to the T-Flex CAD program (Fig. 1).

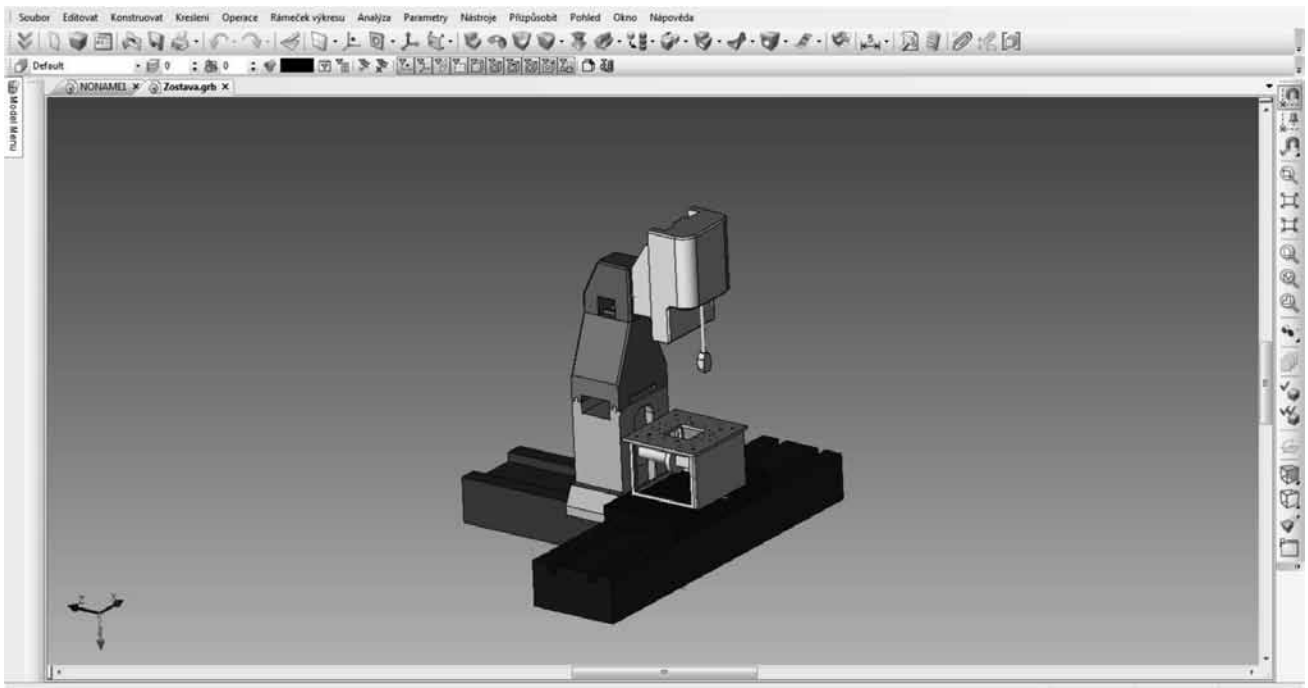

Fig. 1 Working environment of T-Flex CAD program

New quality and higher efficiency of designing have come in the form of designing (CAD) and manufacturing (CAM), computer assisted (Fig. 4). Computer has become a substitute for the drawing board and help in the form of computer-assisted production. In practice, the 2D drafting has gradually been replaced by 3D parametric modelling. First of all, the sketch is drawn here in a similar manner as in 2D. Then, the model of a component is created, mainly by rotation and pulling. It is a very interesting way of work, which does not result in a drawing, but a three-dimensional parametric model of a component. The drawing itself, either its view or cross-section, is created automatically, it only needs to be dimensioned (Fig. 2, 3).

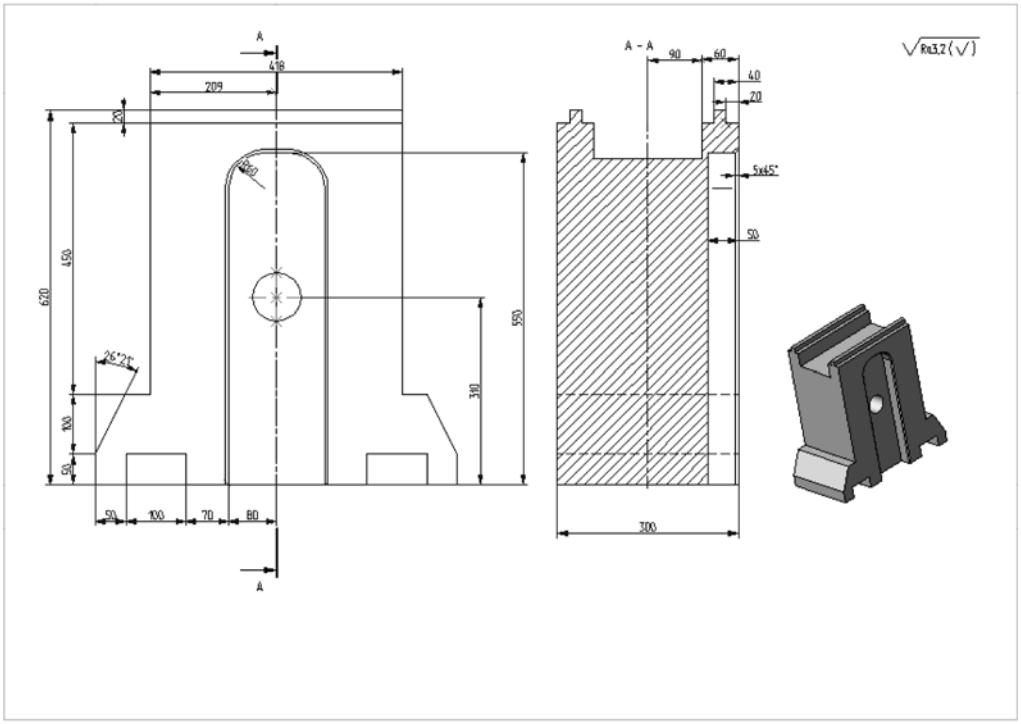

Fig. 2 Drawing of components created using T-Flex CAD program

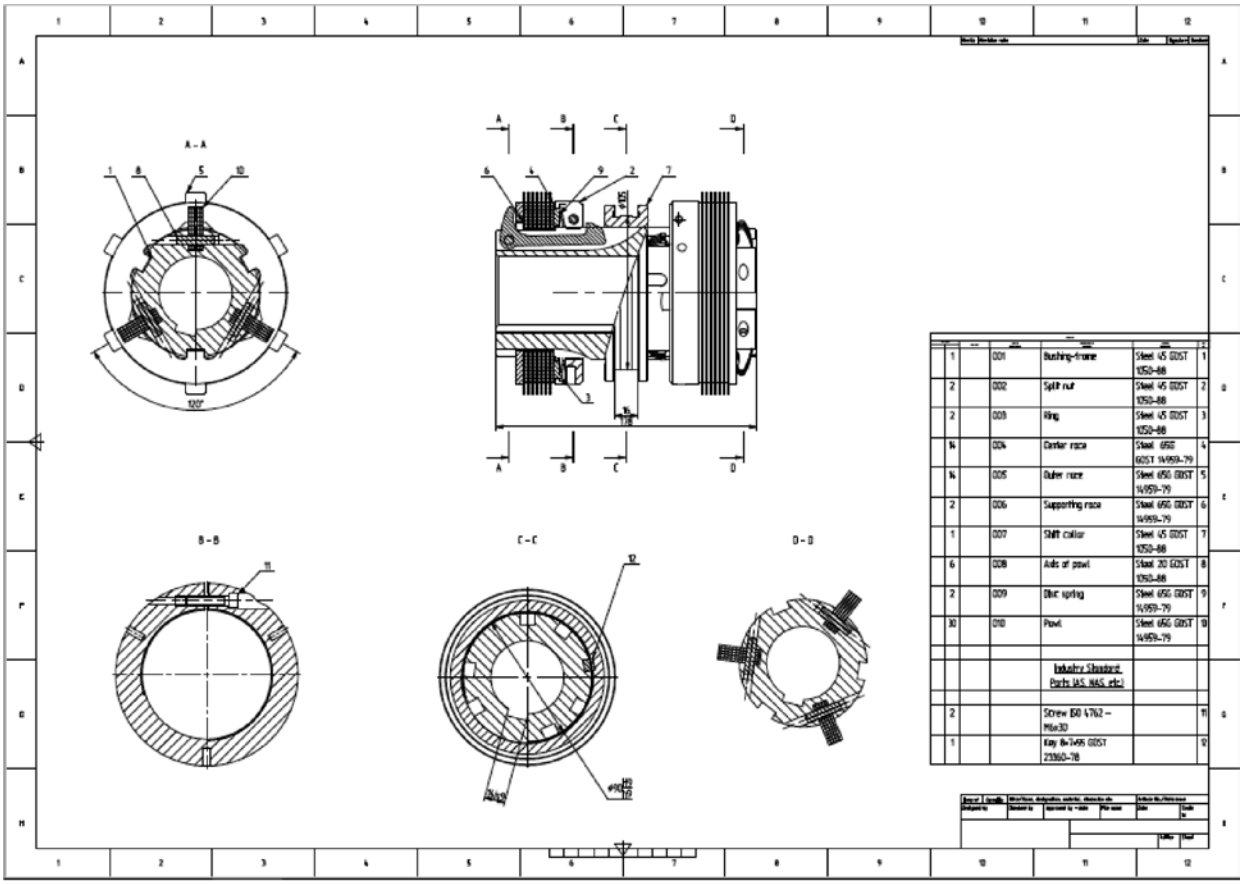

Fig. 3 Drawing of components created using T-Flex CAD program

Any changes in the sketch are automatically reflected in the model and the drawing. These new trends should be captured in technical and vocational schools, another challenging but interesting work for teachers (Klimo, at. al., 2013).

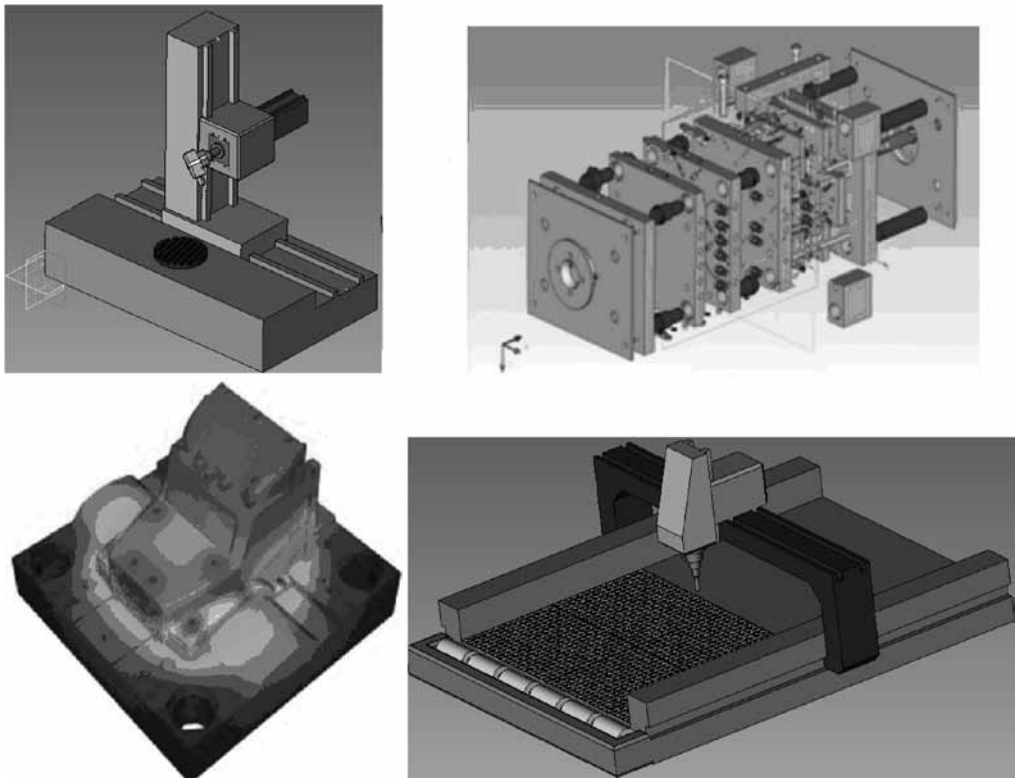

Fig. 4 Examples of T-Flex program design

Summary and conclusions

Digital world is a natural part of the daily life of university students nowadays. New hardware and software school equipment, such as interactive whiteboards, voting machines, laptops and tablets, but also freely available educational software, raise questions about their effective use in the educational process (Vacková, at. al., 2016). Experience shows that the educational research as well as in the area of theory of teaching must move in this direction. Knowledge is part of the flow of information acquired by students every day, further processed, and possessed by them. The role of university teachers is to provide students with the knowledge that can be used in practice after graduation.

When facing the challenges of security, education and training of security services personnel and personnel at different levels of security and management as well as managing workers on which high demands for knowledge are placed, are important aspects. Within university education, improvement of the situation in given area can be achieved by increasing of security awareness of people coming out of school to practice, and by deepening of their knowledge and skills associated with security, by improving qualifications and skills of graduates and preparing them to deal with risk, emergency and crisis phenomena in various aspects of security (civil, economic, environmental, technical and technological, logistical etc.).

A security education system needs to be aimed in such a way that security personnel will be able to gain and acquire knowledge and methods skills on basis of which they will be able to analyse security environment and its factors in relation to various objects. Personnel should also be able to identify and evaluate safety risks and threats and predict their development, determine the procedures and measures of management, security risks and threats, planning and organizing risk management measures, security and crisis management in accordance to resources and capacities available, and design and manage complex security systems. Deficiencies emerg-

ing in security education prevent the effective investigation of professional and societal aspects of security problems, by which the basic cognitive element for the effective management of security systems is limited (Kováčová and Vacková, 2015).

The main effort is to implement the T-Flex program in the teaching process of the study programme Management of Security Systems at the University of Security Management in Košice, as a separate subject based on this design program, which would allow students to design and then comprehensively model security systems with enhanced parametric 2D and 3D. Students will learn the basic capabilities of computer- assisted design. They will become familiar with the working environment of software for 3D modelling of security systems components and learn the basic procedures for modelling of simple 3D objects. Students will be able to use the acquired knowledge and skills when writing their diploma theses, bachelor theses, semester projects, and as a prerequisite for their future application in practice. The introduction of a separate subject with the use of designing in the T-Flex program would result in an increase in the attractiveness and effectiveness of the teaching with links to other subjects within the study programme Management of Security Systems.

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