

## **Секція 6. Інноваційні методики навчання у процесі професійної підготовки фахівців**

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### **INNOVATIVE LEARNING METHOD USING SOLIDWORKS**

Focus on innovative technologies in the field of education, modern material and technical base, highly professional teaching staff - everything is aimed at producing competent specialists, qualitatively prepared to create high-tech developments, thinking progressively and creatively solving assigned problems [1].

The main educational value of innovative technologies is that they make it possible to create a more vibrant interactive learning environment with unlimited possibilities at the disposal of both teachers and students [2].

The advantages of innovative computer technologies compared to traditional ones are manifold. In addition to the possibility of a more illustrative, visual presentation of the material, effective testing of knowledge and everything else, these include the variety of organizational forms in the work of students, methodological techniques in the work of a teacher [3].

Unlike conventional technical teaching aids, innovative technologies make it possible not only to saturate the student with a large amount of knowledge, but also to develop intellectual and creative abilities, their ability to independently acquire new knowledge and work with various sources of information [4].

The extreme operating conditions of the elements of modern structures, the complexity of their shape and large dimensions make it extremely difficult and expensive to carry out full-scale or semi-full-scale experiments, especially when it comes to establishing limit (destructive) loads. The creation of structures (stands) of this type is impossible without improvement and automation of the design process.

At the moment, such stands are not used in car repair shops, and the existing designs are not unified (they are used only for a certain model and its modification). All operations are carried out on metalworking machines. Therefore, the authors of [5] developed a stand for simplifying and accelerating the process of disassembling and assembling gearboxes of car bridges. Compared with a similar rack, both the mechanization and automation of the process, as well as the convenience and quality of disassembling and assembling units, increase, and the work becomes easier.

But the performance of the stand depends on the strength characteristics of its parts. Therefore, with the help of SolidWorks Simulation, the following studies were carried out:

– the authors [6] analyzed the model of the movable leaf to obtain a picture of its stress-deformed state;

- in work [7], a similar study of a fixed leaf was performed;
- the authors [5] carried out a static calculation of the stand lock.

Since the stand contains other parts, we will conduct a static calculation of the stand finger. At the same time, we will complicate the calculations: we will determine the maximum load it can withstand in the event of a violation of safety techniques during the operation of the stand with the planned safety factor  $n = 2.5$ .

The process of conducting a static analysis begins with the creation of a geometric model of the finger in SolidWorks. The next stage is the selection of the material planned for its manufacture from the SolidWorks Simulation library.

After determining the grade of steel from which the finger is made (steel 40X) and its mechanical characteristics ( $\sigma_B = 845 \text{ MPa}$ ,  $\sigma_T = 590 \text{ MPa}$ ), steel DIN 1.7030 (28Cr4) was selected from the SolidWorks library – an approximate analogue of the material of the finger, for which  $\sigma_B = 850 \text{ MPa}$ ,  $\sigma_T = 650 \text{ MPa}$  ( fig. 1).

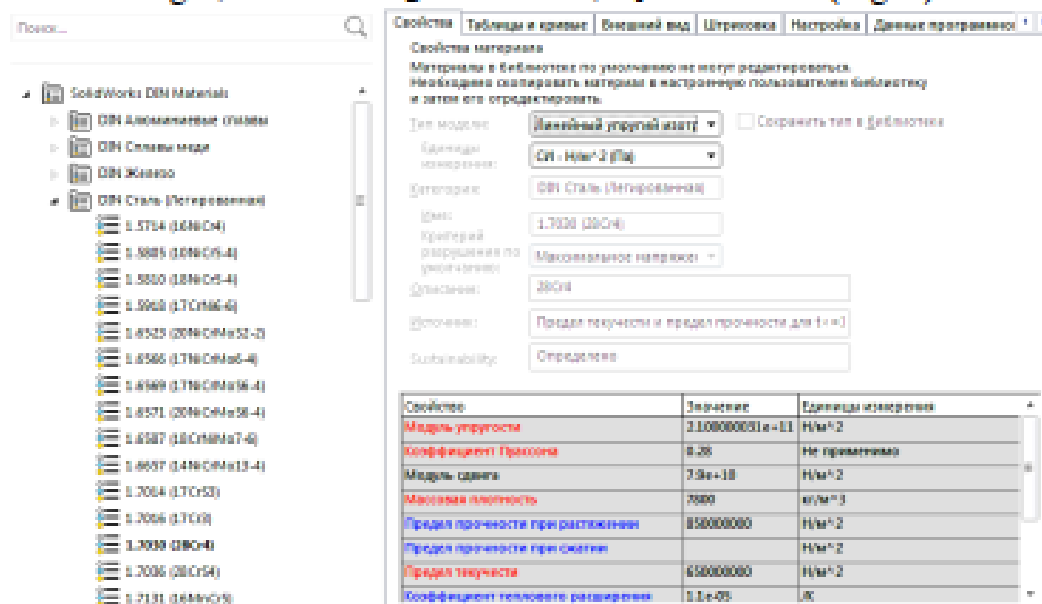


Figure 1 – An approximate analogue of the material of the finger

After that, the finger model is fixed and a load is applied to it (fig. 2).

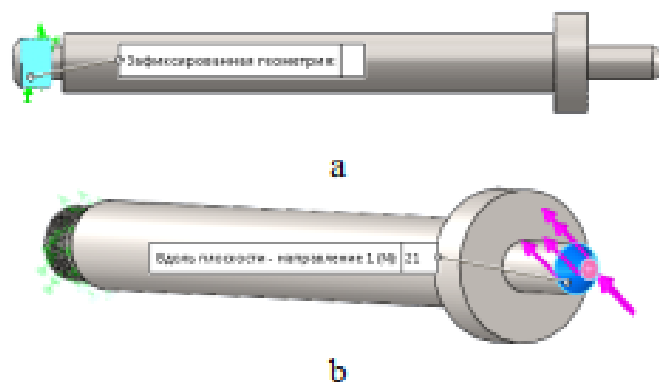


Figure 2 – Working with a 3D model of a finger in SolidWorks Simulation: a – fixing, b – applying a load

Thus, the model is divided into elements connected at common nodes: the finite element analysis program considers the model as a grid and predicts its behavior by comparing the information obtained from all the elements that make up the model (fig. 3).

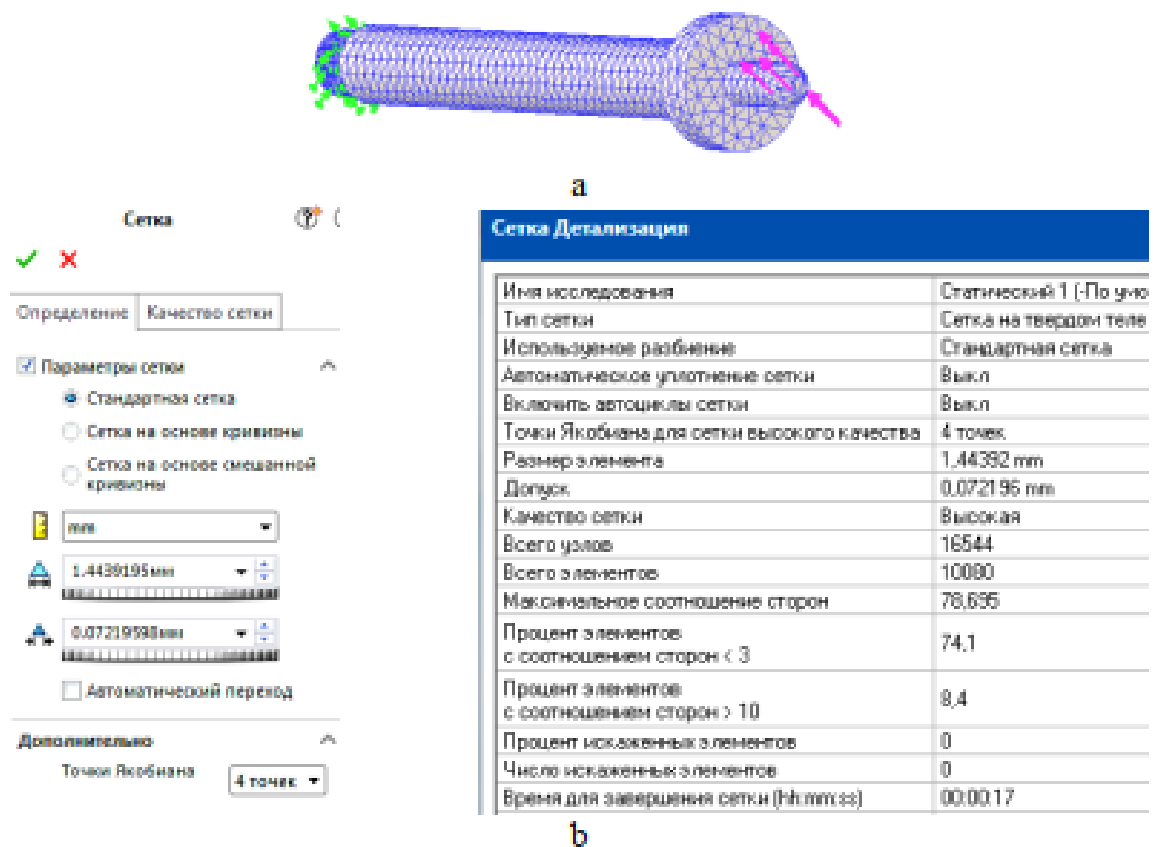


Figure 3 – Finger model mesh (a) and its detailing (b)

The result of the static analysis of the finger is the resulting forces and moments (fig. 4), the fields of stresses, displacements, deformation, margin of safety, the limit values of which are shown in fig. 5 and in table. 1.

**Результирующие силы**

**Силы реакции**

Выбранный набор	Единицы	Сумма X	Сумма Y	Сумма Z	Результирующая
всей модели	N	-0,000566006	-20,9902	-0,00314093	20,9902

**Моменты реакции**

Выбранный набор	Единицы	Сумма X	Сумма Y	Сумма Z	Результирующая
всей модели	N.m	0	0	0	0

**Силы свободных тел**

Выбранный набор	Единицы	Сумма X	Сумма Y	Сумма Z	Результирующая
всей модели	N	0	0	0	0

**Моменты свободных тел**

Выбранный набор	Единицы	Сумма X	Сумма Y	Сумма Z	Результирующая
всей модели	N.m	0	0	0	0

Figure 4 – The resulting forces and moments

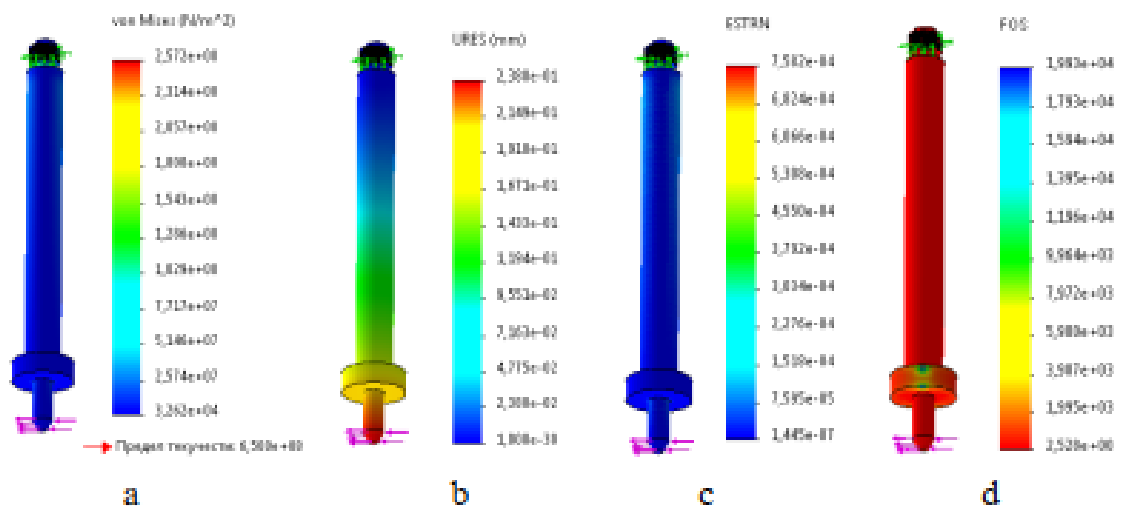


Figure 5 – The results of the static analysis of the finger – field:  
 a – tension; b – movements; c – deformations; g – margin of safety

According to fig. 5, d, with the planned safety factor  $n = 2.5$  (see Table 1), the finger will withstand a load of 21 N.

**Table 1 – Results studies of finger**

Name	Type	Min.	Maks.
Tension	VON: Tension Von Mises	3,262e+04N/m <sup>2</sup> Node: 9376	2,572e+08N/m <sup>2</sup> Node: 12880
Movements	URES: As a result movements	0,000e+00mm Node: 318	2,388e-01mm Node: 13097
Deformations	ESTRN: Еквівалентна деформація	1,445e-07 Element: 7606	7,582e-04 Element: 1947
Margin of safety	Auto	2,528e+00 Node: 12880	1,993e+04 Node: 9376

Therefore, the capabilities of modern computers provide, with the help of SolidWorks, modeling of various processes and obtaining an acceptable result without time-consuming field experiments.

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## **DEPENDENCE OF ORGANISM SENSITIVITY TO EXTERNAL FACTORS ON HUMAN TYPOLOGICAL BELONGING**

Modern life is characterized by increase in population mutational load and ecological problems, disturbances in life style that result into rising in pathological conditions weight, human being bigger sickness and weaker health; appearance of new syndromes and diseases, new distinguishing features in known diseases and syndromes course; a row of new allergens appearance lead to significant autoimmune and allergic pathology distribution in modern human beings. It is on the one hand. On the other hand, specialists from many Earth parts address more and more often to so called typological belonging or typological aspects in part in relation to human health representing integral category, one of which component is sensitivity to external factors.

Correlations between locus of control and health are tried to be studied widely and there exists a term “health locus of control”; there exist Multidimensional Health Locus of Control scales; health locus of control was and is assessed at many diseases, in part at diabetes mellitus in Nigeria [1], insulin-dependent and insulin-independent diabetes mellitus, in correlations with body mass index [2], ovarian cancer (while gender typological aspect taking into consideration) [3] as well as at breastfeeding in Nigeria (ethno-gender-age typological aspect), aging, in part, at ishemic heart disease as well as because of pathological conditions significant set and vast distinguishing