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APPLICATION OF SOLIDWORKS IS FOR PROFESSIONAL PREPARATION OF SPECIALISTS

Vocational training is a set of special knowledge, skills and abilities that allow you to perform work in a particular field of activity. Its goal is to accelerate the acquisition by professionals of the skills needed to perform a particular job.

The requirements for the training of specialists show that the effectiveness and success of future professional activity depend on whether they will meet the needs of professional growth and how ready they will be for self-improvement.

Today, professional training reaches a higher technological level, as there is a need to find new learning technologies. This is due to the abandonment of traditional education and the idea of its manufacturability and innovation. Thus, the primary task of modern higher education is to improve the quality of training of professionals capable of active creative activity. Therefore, one of the issues of improving the quality of professional training in the near future is the introduction of modern computer technology in the educational process.

The use of information technology (IT) is of great interest in creative tasks, the opportunity to test their knowledge and get qualified advice. IT helps to implement an individual-oriented approach to learning, provide individualization and differentiation, taking into account the characteristics of specialists [1].

In addition, IT increases the ability to set learning objectives and manage the process of their implementation, involve students in the learning process. This contributes to the wide disclosure of their abilities, the activation of mental activity.

Therefore, the introduction of technical (engineering) cycle of modern methods in teaching allows to move from traditional methods of teaching design to modelling using CAD-systems with the subsequent use of CAE / CAD automated systems. One of them is the 3D system of automated design (CAD), engineering analysis and preparation for the production of SolidWorks products [1].

SolidWorks allows you to create flexible parametric models of products of any complexity and get a refined picture of the stress-strain state of the model. Its tools

The system has two levels of functional dependencies: the first provides a connection between the parameters of the model when recalculating their values, the second – connection with CAD when restoring the product in accordance with the obtained values of the parameters. The combination of these two types of dependences allows to achieve extraordinary results, without actually limiting the flexibility of the resulting model.

One of the applications of this program is SolidWorks Simulation [1, 2] - calculations for the strength of structures in the elastic zone; setting and solving contact problems; compilation calculations; determination of natural forms and frequencies of oscillations; calculations of structures for stability and fatigue; imitation of a fall; thermal calculations; nonlinear calculations (taking into account nonlinear properties of the material, nonlinear loading, calculations of nonlinear contact problems); analysis of fatigue stresses and determination of the service life of structures; linear and nonlinear dynamics of deformed systems, etc.

As an example, the screw of a special device (fig. 1) for compressing the front suspension springs was investigated using SolidWorks Simulation [3]. But this device can fail due to insufficient performance of other parts, such as the bottom plate (fig. 2).

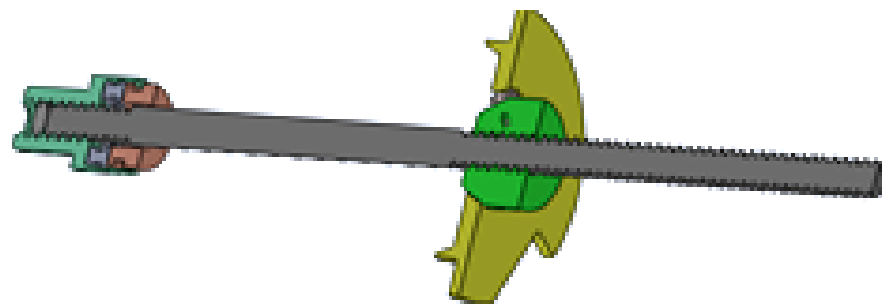


Figure 1 – 3D model of the device for compressing the front suspension springs

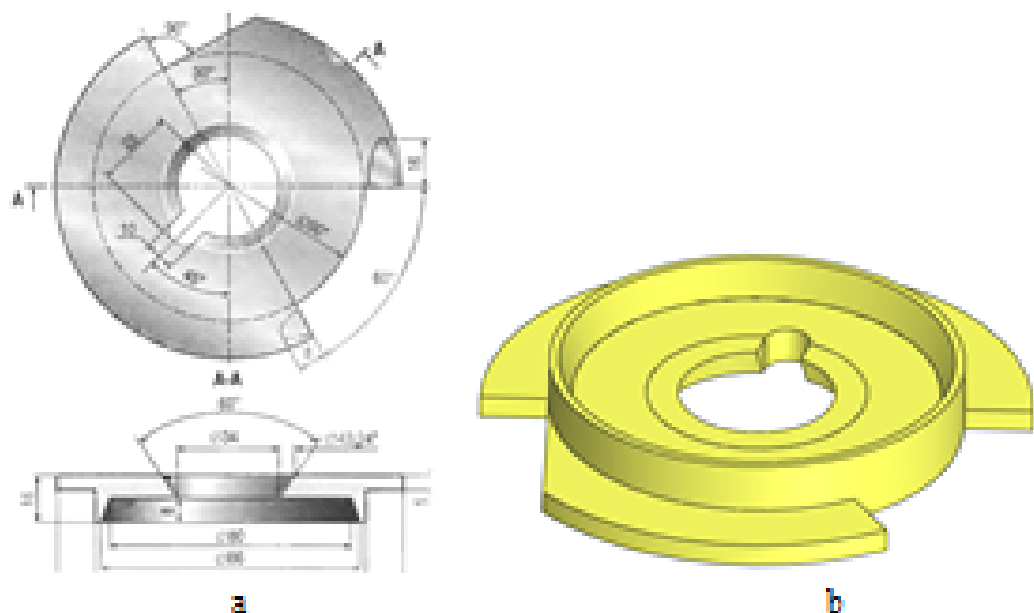


Figure 2 – Drawing (a) and 3D model of the bottom plate

Therefore, SolidWorks created a geometric model of the bottom plate (fig 2, a), then introduced the properties of the material from which it is made (steel 45 – DIN 1,1191, C45E). After that, the lower plate supports were defined and the load area was set (normal force $F = 3200$ N [3] – fig 3, a), contact interactions were determined and a finite element model of the system was created.

Grid parameters (fig 3, b): 4 Jacobian points, element size 4.05677 mm, tolerance 0.202839 mm, grid quality is high, total nodes 13944, total elements 7932, maximum aspect ratio 7.3001, percentage of distorted elements 0.

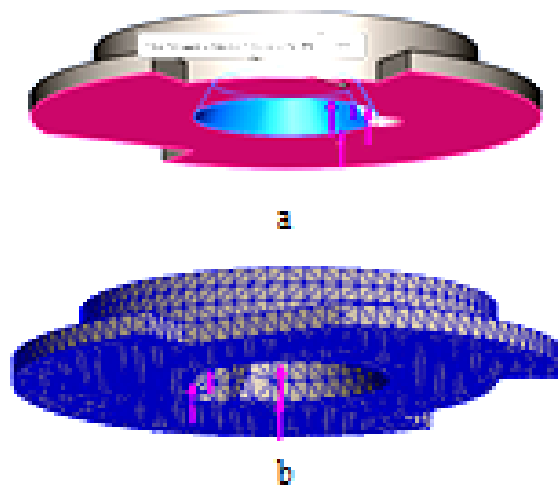


Figure 3 – Application of load (a), the reflection of the grid on the solid body of the plate (b)

SolidWorks Simulation software develops algebraic equations based on the connections between elements. They associate the reaction with the property's properties, limitations, and loads. After arranging the equations into a large common system are the unknowns.

The results of static analysis are depicted in the form of a colour gradient, which shows the change in colour distribution of the calculated parameters (fig 4, 5). Von Mises maximum stress stresses, URES displacement, equivalent ESTRN strain and FOS strength factor are set for the plate (fig. 6).

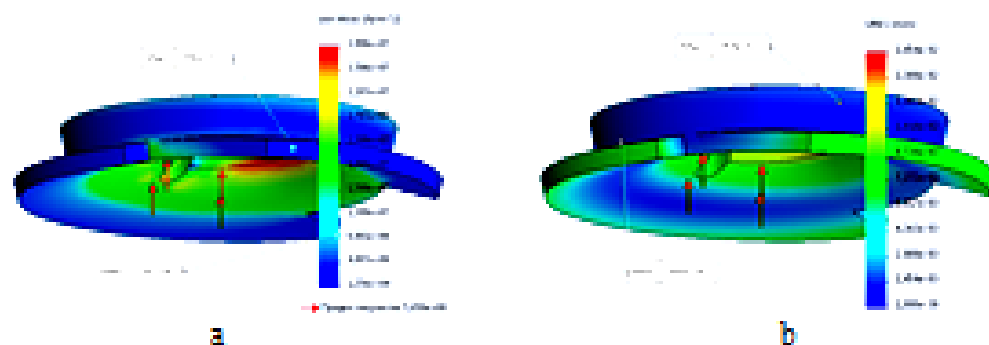


Figure 4 – Diagrams of the distribution of nodal stresses (a) and displacements of the plate (b)

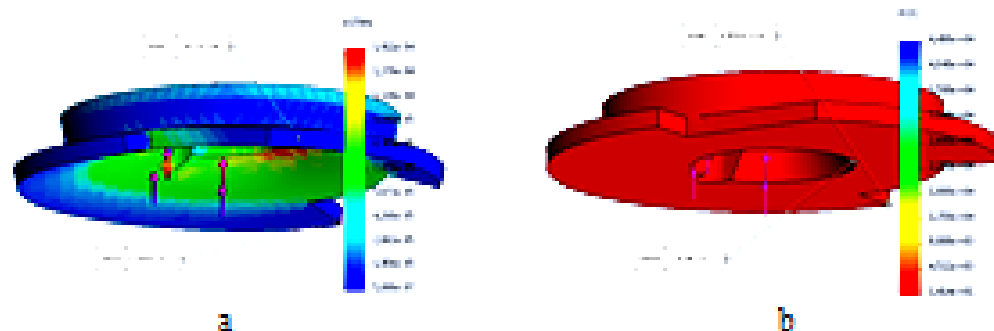


Figure 5 – Diagrams of the distribution of deformations (a) and the margin of strength of the plate (b)

Имя	Тип	Мин	Макс
Напряжение1	VON; Напряжение Von Mises	1,256e+04N/m ² Узел: 438	3,996e+07N/m ² Узел: 420

a

Имя	Тип	Мин	Макс
Перемещение1	URES; Результующее перемещение	0,000e+00mm Узел: 1	1,454e-02mm Узел: 414

b

Имя	Тип	Мин	Макс
Деформация1	ESTRN; Эквивалентная деформация	5,088e-07 Элемент: 6841	1,411e-04 Элемент: 35

c

Имя	Тип	Мин	Макс
Запас прочности1	Авто	1,414e+01 Узел: 420	4,498e+04 Узел: 438

d

Figure 6 – Set for the plate nodal maximum stresses Von Mises (a), displacement URES (b), equivalent deformation ESTRN (c) and the safety factor FOS (d)

Thus, the strength parameters of the lower plate provide its static strength (safety factor $n = 14.14$, which is more than the allowable $[n] = 3$). But for the final conclusion regarding the efficiency of the device for compressing the springs of the front suspension, it is necessary to perform similar calculations for other parts of the device.

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