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# USING SOLIDWORKS IN MODERN EDUCATION AND SCIENCE

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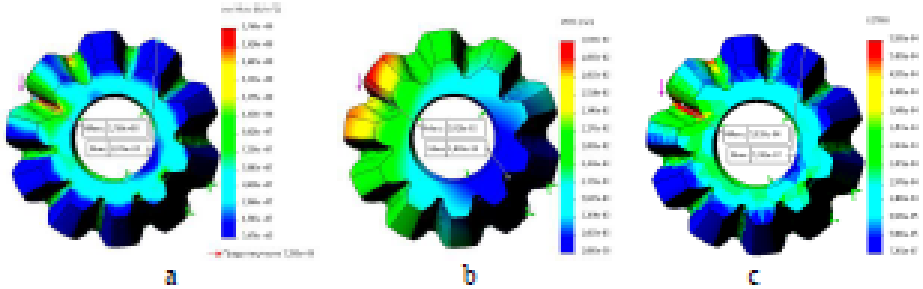
*The use of the SolidWorks CAD/CAM/CAE/PDM system and its SolidWorks Simulation application for solving problems of the mechanics of a deformed solid body in the specialty "Automotive transport" is under consideration: the performance of the satellites of the front axle differential of the LuAZ car, impact on the stability of the steering bipod of the LiAZ bus, the possibility of optimizing the clutch lever of the tractor.*

Computer technologies (or they are also called "CALS-technologies" – Continuous Acquisition and Life cycle Support) provide ample opportunities for students to study various aspects of the automation of the design of automotive parts, as the "Automotive Transport" specialty is a priority in Ukraine and the world.

The main feature of modern graphic training of engineers in this specialty is 3D modelling, since information models are present at all stages of the life cycle of car parts. Therefore, a technology for teaching engineering disciplines was developed, which uses a single tool – the basic CAD/CAM/CAE/PDM-system SolidWorks as a cross-cutting means of learning in all technical disciplines of the curriculum: solid-state 3D-design in the first courses of study, engineering calculations (the SolidWorks Simulation application) – on the latest.

SolidWorks Simulation is designed for solving problems of the mechanics of a deformed solid body using the finite element method (numerical simulation). This is software for calculations of static strength and stability in linear and non-linear construction, selection of natural frequencies, optimization of the shape of parts and assemblies in linear construction, analysis of fatigue and behavior of the structure when falling. The program uses a geometric model of a SolidWorks part or assembly to form a calculation model. Integration with SolidWorks makes it possible to minimize operations associated with specific features of finite-element approximation.

As an example of the use of SolidWorks, an e study of the performance of satellite differentials of the front axle of the LuAZ car was carried out [1]. The results of static analysis are depicted as a color gradient, which shows by changing the color distribution of the calculated parameters (fig. 1). That is, withthe help of a virtual model, it became possible to analyze stresses, movements and equivalent shaft deformations.

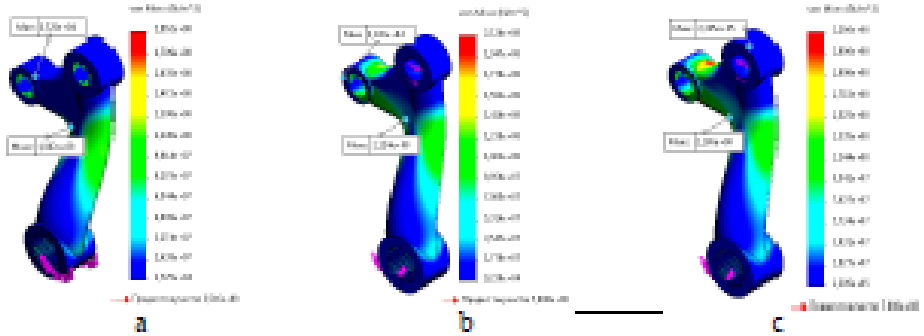


a b c

Figure 1 – Diagram of the distribution of nodal stresses (a), displacements (b), deformations (c) of the satellite

The authors [2] studied the effect of impact on the stability of the steering bipod of the LiAZ bus. The following options were considered: impacts with the left and right wheels when turning the car, as well as the basic option – turning in place (without an impact). The results of the calculations

are shown in fig. 2 (a – turning in place; b – impact with the left wheel; c – impact with the right wheel).

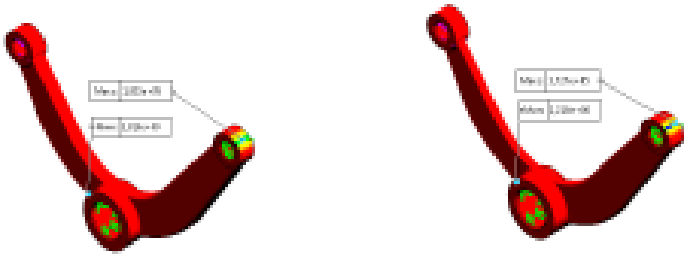


a b c

Figure 2 – Distribution of equivalent stresses in the model of the steering bipod

Thus, the use of SolidWorks Simulation allows you to explore the strength characteristics of the elements of the car, which directly affect the stability of its movement.

In work [3], the possibility of optimizing the tractor clutch lever (ie, changing the design of the lever to save material) was investigated – reducing the thickness of the stiffening rib from 10 mm (fig. 3, a) to 6 mm (fig. 3, b). The established margin of safety is more than permissible (n = 1,5) , and the weight of the lever has decreased by 39%. That is, the use of SolidWorks Simulation made it possible to optimize the design of the lever and avoid unnecessary costs for excess material.



a b

Figure 3 – Margin of safety of the lever

Thus, the Application of SolidWorks causes increased interest in creative tasks, an opportunity to test your knowledge and receive qualified advice. In addition, SolidWorks:

– increases the possibilities of setting educational tasks and managing the process of their implementation;

– involves students in the educational process;

– contributes to wide disclosure of students' abilities, activation of their mental activity.

## REFERENCES

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