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SOFTWARE OF DESIGN PROCESSES OF REDUCING GEAR

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Abstract. The possibilities of 3D modeling for the implementation of the course project in the disciplines «Machine parts», «Machine parts and design basics», «Mechanics», «Applied mechanics» are considered. In this case, the SolidWorks program and its SolidWorks Simulation application, designed for automated strength analysis of the project structure, were used.

Keywords: SolidWorks, reducer, design, calculations, Simulation.

One of the most important tasks of modern mechanical engineering is to ensure the quality indicators of manufactured products with a significant reduction in design time. The use of information technologies in the framework of CAD/CAE/CAM-systems allows at the design stage to reduce the complexity of design due to a quick and reliable assessment of the strength, rigidity, and stability of mechanisms.

In modern CAD/CAE/CAM design systems, first, three-dimensional computer models of structures are built, and then product drawings are automatically created.

A reducer is a mechanism that consists of gears or worm gears, made in the form of a separate unit and used to transmit rotation from the motor shaft to the shaft of the working machine. The purpose of the gearbox is to reduce the angular velocity and, accordingly, increase the torque of the driven shaft compared to the driving one.

Reducers are widely used and important objects of mechanical engineering. They can be primarily classified by the type and number of mechanical gears, as well as by a number of other parameters (case type, gear ratio, dimensions, etc.).

In this paper, the possibilities of 3D modeling for the implementation of a course project in the disciplines "Machine parts", "Machine parts and design basics", "Mechanics", "Applied mechanics" are considered. At the same time, a computer-aided design system was used that uses a Microsoft Windows graphical user interface - SolidWorks, which allows:

– to visualize the mechanism and its operation;

– to build various three-dimensional models of technical objects;

– check the correctness of the calculations of the geometric parameters of the parts and their assembly into units and the product;

– create two-dimensional drawings.

As a result, the three-dimensional model of the reducer (volumetric layout), compared to the flat one, leads to the choice of a rational design option faster and more efficiently.

When designing reducers, the difficulties lie in the fact that their parts have several planes and a significant number of mutually coordinated holes. Therefore, the process of their design is divided into many operations: on the basis of sketches and with the help of extrusion, rotation, cutting tools, the shape and volume of parts are created.

Examples of SolidWorks application with further use application program of computer engineering analysis SolidWorks Simulation, designed for automated strength analysis of the design of the project, for the course planning [1]:

– equalization of the practicality of the drive shaft-gear of the final reducer with the durability strength [2];

– prediction of the strength of the keyway and the hole for the fastening (fixing) screw in case of loosening of the press fit of the worm crown on the hub in the worm reducer [3];

– computer verification of the calculations of the gear wheel performed during the design of the bevel reducer [4, 5];

– verification assessment of the strength of the drive gear of a cylindrical helical gear reducer [6].

Based on the work done, the following conclusions were drawn:

– the difficulties of creating a 3D model of the reducer are compensated by the easier creation of an assembly drawing of the product;

– visual images of the mechanism in operation from any angle improves the perception and understanding of the material of the course of machine parts;

– it is advisable to carry out course design using advanced computer-aided design methods, when the created three-dimensional model is the basis for drawings.

Using SolidWorks as the main design tool allows not only to build a 3D-model of a part, but also to create a model of the entire device (assembly). Modern integrated solid modeling systems have built-in modules (subroutines – in this case SolidWorks Simulation) for engineering analysis, which allow the design engineer to simulate the effect of workloads (both on individual parts and the assembly as a whole), make the necessary adjustments to the design of reducers on early design stages.

Thus, the use of SolidWorks with the SolidWorks Simulation application allows

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you to rationalize the execution of drawing work, as well as increase the speed of transfer of educational information.

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