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INSPECTION OF THE STRENGTH OF THE COLUMN LATTICE OF THE IMPROVED FIBER CLEANER

RAKHIMOV RASHID

Senior teacher, Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0890) 641-7400, E-mail.: rgrakhimov80@gmail.com
ORCID: 0009-0008-9254-4676
Corresponding author

SULTONOV MIRZAOLIM

PhD, Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0894) 175-6336, E-mail.: smirzaolim6336@gmail.com
ORCID: 0000-0002-6647-5629

Abstract: In this article, the strength testing of the combed wire mesh, which constitutes an improved cotton fiber cleaning device, was carried out in the Solid Works program. As a result, it was found that the minimum strength reserve of the combed wire mesh is sufficiently high, so the probability of structural failure or plastic deformation in the model is very low.

Keywords: fiber, fiber cleaner, improvement, column, column grid, productivity, durability, graph, diagram.

Introduction. The main advantage of the improved fiber cleaning device is that the effective cleaning surface area is increased by increasing the number of rows of grates to 8, which significantly increases the efficiency of dirt removal [1].

The waste is discharged from the fiber cleaner by a belt conveyor or screw conveyor. The amount of air sucked into the waste chamber of the fiber cleaner is adjusted by changing the position of the individual louvered blades 3.

Based on the above, the chosen direction of the research was determined to improve the cleaning efficiency of straight-flow fiber cleaning machines and create convenience for their maintenance based on the modernization of the 1VPU straight-flow single-drum fiber cleaner.

Methodology & empirical analysis. In the study, the improved comb grate and other working bodies were manufactured in the repair shop of the Kosonsoy cotton ginning enterprise (Figure 1).

The columns that make up the grid of the grid are made of steel-45, and the physical and mechanical properties of the material were tested in the Laboratory of Machinery and Equipment of the Tashkent Institute of Textile and Light Industry.

Figure 1. Experimental Copy of the Columns Lattice

The grate of the improved fiber cleaner is exposed to external loads due to the high speeds of the saw drum moving along the surface of the fiber mixture. In addition, the fact that the grate thickness is significantly reduced (7 mm) also serves as a basis for checking its strength. Insufficient strength and rigidity of the grate, as well as vibrations, can lead to a deterioration in the process of separating the fiber from the saw cylinder, deterioration of the fiber quality, clogging of fibers in the grate or disruption of the cleaning process, and premature failure of the details due to uneven wear. Therefore, it is very important to perform grate strength calculations [2].

II. Results. The engineering calculation of a random part begins with its static analysis. First, we perform a static calculation of the existing grid. For this, we use the Simulation package of the SolidWorks program. The grid is modeled in 3D (Figure 2), the material of the grid, the installation conditions, external forces (weight force and distributed fiber force) are selected and their values are entered. Since the machine productivity is 1200 kg/h, about 0.75 kg of fiber per second is distributed on the grid surface. We assume the distributed mass to be 6.5 kg [3-5]. In order to prevent the grids from bending, supports are not installed.

Figure 2. General view of a grid with columns

Initially, the following parameters were determined using the program:

Construction mass: 20.3765 kg, volume: 0.0027913 m^3, density: 7300 kg/m^3, tensile force: 199.69 N.

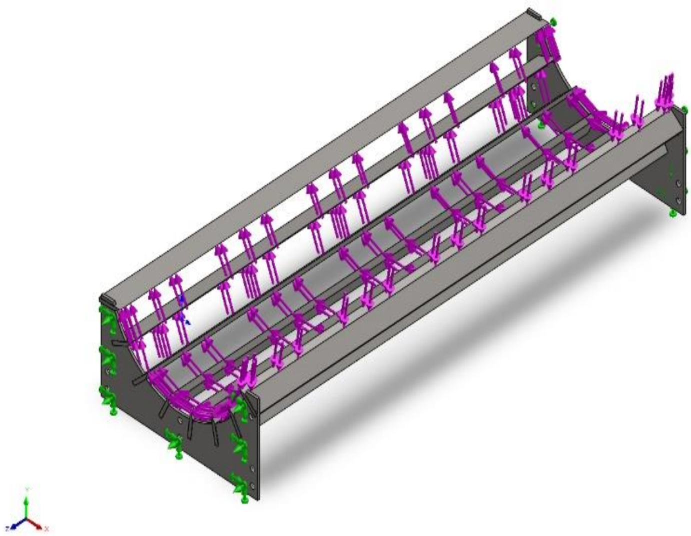

Figure 3. Model scheme for calculating strength

Figure 3 clearly shows the model. The elements of this structure are used in different directions, the structure is symmetrical, and the external elements are designed to absorb the force. The red and green arrows represent the forces acting on the structure.

After performing all the necessary steps, the program solves the problem and displays the result in the form of colored graphs (Figure 4).

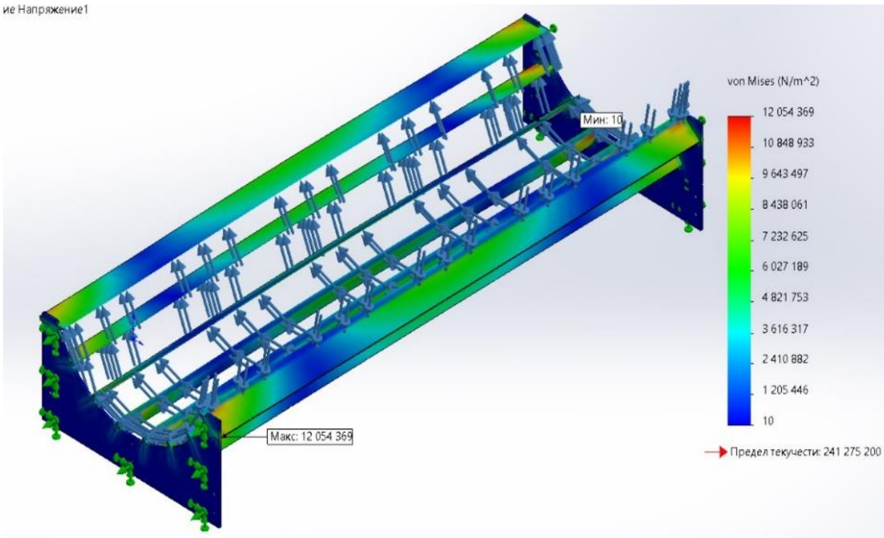

Figure 4. Scheme of the effect of deformation

Figure 4 shows the results of the stresses and total deformations applied to the body. The study revealed the following key data:

Stresses (Von Mises)

- Min. value: 3349 N/m²
- Max. value: 12054 N/m²

The stresses are high in some areas, especially in the areas shown in red.

Deformations

- Min. value: 0 mm
- Max. value: 0.577 mm

The peak deformation is very low, which indicates that the structure is very rigid.

The areas shown in red should be compared with the ultimate tensile strength of the material. If the value of 12054 N/m² exceeds the material limit, the structure may experience failure or plastic deformation.

The highest deformation (0.577 mm) is considered small for the overall model, which confirms the strength of the structure.

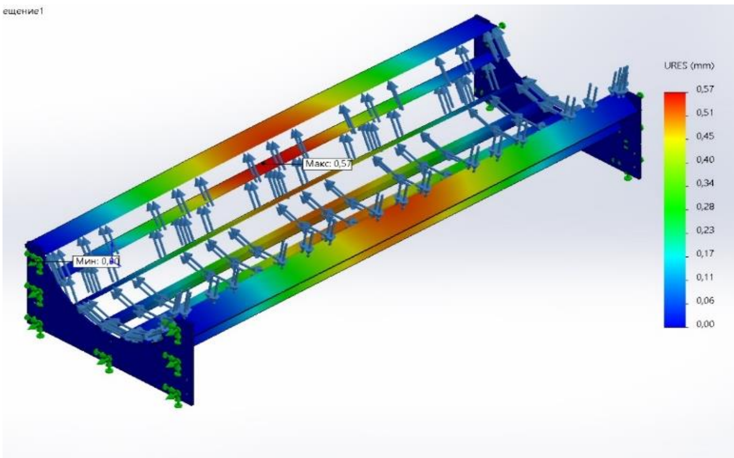

Figure 5. Grid element displacement diagram

The minimum value in the displacement diagram is found to be 0 mm (Figure 5) and the maximum value is 0.0004 mm, which means that the displacement has very small values, which indicates that the structure is robust. Usually, such small displacements meet the analysis requirements.

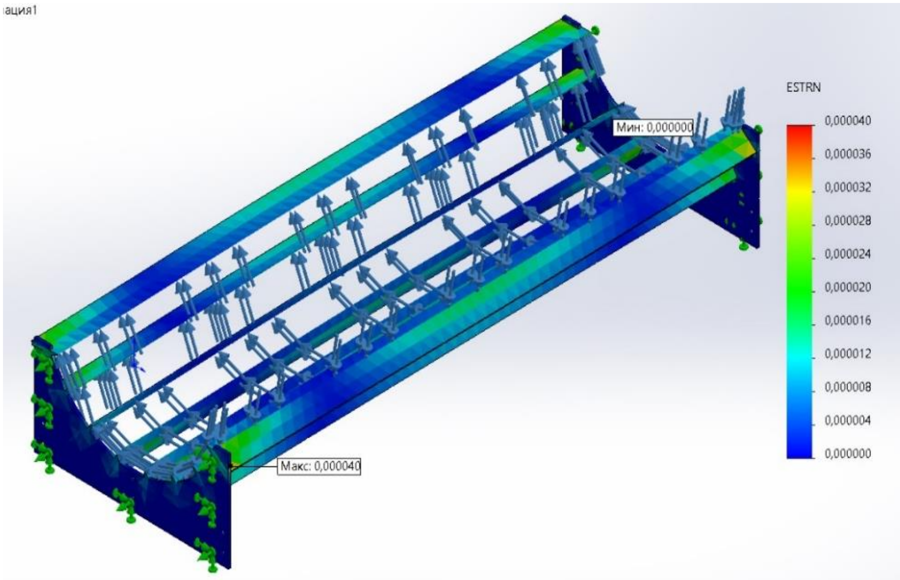

Figure 6. Scheme of equivalent lattice deformations

In the Equivalent Strain diagram (Figure 6), the minimum value is 0 and the maximum value is 0.000040.

The minimum equivalent strains are evidence of the high strength of the structure and do not violate the material limits. The red diagram shows areas where high strains can occur. If the areas of high stress or strain are important in the operation of the structure, these areas should be reviewed.

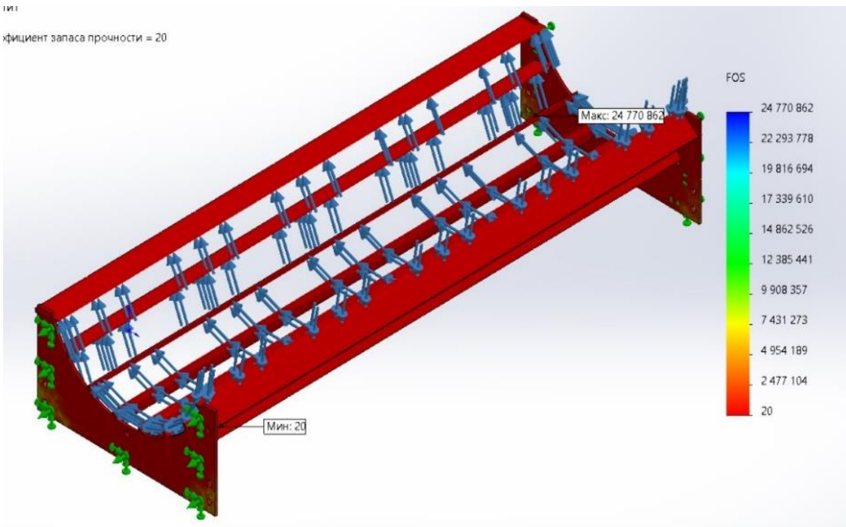

Figure 7. Strength reserve of the lattice

III. Conclusions. The areas marked in red have the minimum strength reserve. For parts with very high strength reserves (around the maximum value), it is necessary to optimize material consumption and may make the model heavier to avoid excessive material consumption in these areas.

The model is generally considered robust, as the minimum strength reserve is 20, fully meeting the requirements.

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