MATHEMATICAL MODELING OF THE BODY OF THE DEVICE FOR DISASSEMBLING CONNECTIONS Of TENSION

Rudyk O. Yu., Zelenska L. I., Seredyuk M. I.
Khmelnytskyi National University, Khmelnytskyi Polytechnic College

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The use of mathematical modeling in the design of various structures and machines is dictated by the need to continuously improve the quality and reliability of products, as well as the possibility of using new structural materials, given the complex operating conditions of modern products. The maximum effect of using computer-aided engineering (CAE) technologies is achieved when they are applied from the early stages of design. This reduces the cost of the product, the likelihood of risks, and the time it takes to bring a product to market.

The authors [1] considered the application of mathematical modeling on the example of calculating the body (made of DIN 1.1191 steel) of a device for disassembling connections of tension (they used SolidWorks). It was established that the minimum safety factor is k = 1.739. But this coefficient depends on the responsibility of the structure [2]. And for devices for the repair of automotive equipment (pullers, jacks, lifters, stands, etc.), where manual labor is used, it is 2.5-3.0 and more [3-6]. Therefore, it is necessary to either change the design of the case (increase its size), or apply a strengthening treatment (thermal or chemical-thermal) to the existing one, or choose a stronger material. We choose the simplest option – we use stronger steel DIN 1.6580 (fig. 1).

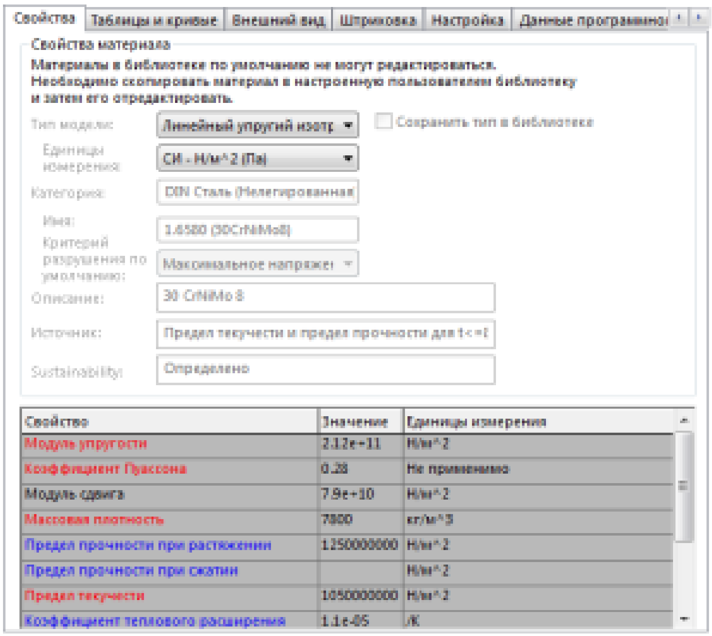
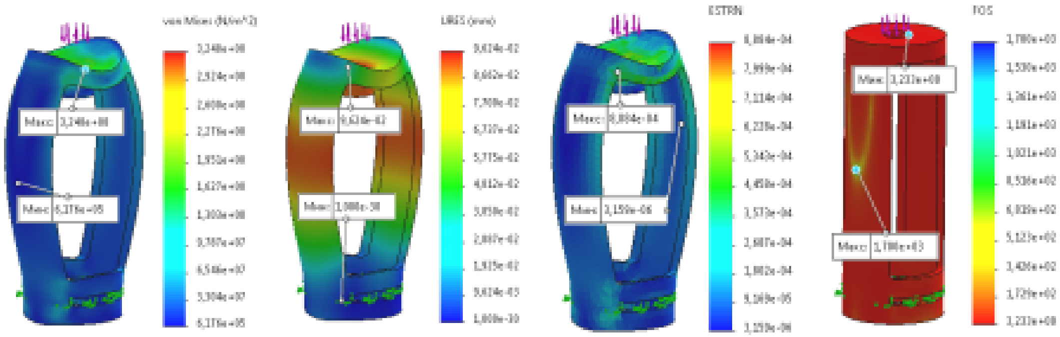


Figure 1 – Steel parameters DIN 1.6580

After repeated calculations in SolidWorks Simulation (separation of the hull model into finite elements, construction of the stiffness matrix; synthesis of the finite element model taking into account the conditions of its fixation at nodal points; solving the resulting system of algebraic equations), the components of the stress-strain state of the hull were determined (fig. 2).



a b c d

Figure 2 – Plots of total von Mises stresses (a), displacements URES (b), equivalent strains ESTRN (c), margin of strength FOS (d) of the hull

Since the minimum margin of safety factor for a body made of DIN 1.6580 steel is k = 3,233, which is more than the permissible limit, the margin of safety is sufficient.

References

1. Devlysh V. A. End-to-end computer training at the base SolidWorks [Electronic resource] / V. A. Devlysh, O. V. Borovyk, O. Yu. Rudyk. – Access mode: http://elar.khnu.km.ua/jspui/handle/123456789/8402
2. Safety factor [Electronic resource]. – Access mode: https://uk.wikipedia.org/wiki/Коефіцієнт_запасу_міцності
3. Rudyk O. Yu. Use SolidWorks Simulation to calculate bearing stripper grip [Electronic resource] / O. Yu. Rudyk, V. S. Pryvedenets. – Access mode: http://elar.khnu.km.ua/jspui/handle/123456789/6454
4. Rudyk O. Yu. Using of SolidWorks for simulation of screw puller of bearings [Electronic resource] / O. Yu. Rudyk, P. V. Kaplun, R. V. Solovyov. – Access mode: http://elar.khnu.km.ua/jspui/handle/123456789/10062
5. Rudyk O. Investigation of a universal puller of bearings with SolidWorks [Electronic resource] /O. Rudyk, P. Kaplun, V. Honchar. – Access mode: https://journals.nmetau.edu.ua/index.php/itmm/issue/view/122/91
6. Rudyk O. Yu. Mathematical modeling of devices for motor vehicle repair based on SolidWorks Simulation / O. Yu. Rudyk, S. V. Turytskyi // Informatics, information systems and technologies: abstracts of reports of the sixteenth all-Ukrainian conference of students and young scientists. Odesa, April 23, 2021. – Odesa: ONU, 2021. – P. 77-79. – URL: http://elar.khnu.km.ua/jspui/handle/123456789/10223