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DEVELOPMENT OF CONSTRUCTION FOR THE TRANSFER OF HEAVY PRISMATIC PROFILES

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1. Introduction

Determining the load capacity of machine parts used in the transport of heavy profiles is a challenging, but also very responsible task for any engineer. This process requires a detailed analysis of loads, deformations and critical points where local damage or system failure can occur. In modern mechanical practice, the application of the finite element method (FEM) is becoming an indispensable tool due to its precision in predicting the behavior of materials, as well as the ability to quickly and efficiently vary geometry and boundary conditions [1,3]. FEM enables the simulation of real working conditions of the structure with minimal costs of experimental testing, which gives engineers wider possibilities in optimizing structural solutions. The load-bearing capacity of steel profiles is influenced by a number of parameters, among which the choice of material [4], the method of support and stiffening of elements, geometric shape, as well as the appearance of sources of stress concentration that can lead to the initiation of cracks and reduced reliability [5]. Each of these factors must be carefully considered in the design process to ensure the safety and longevity of the structure. Through this study, the process of variation of the geometry of the developed assembly for the transmission of massive profiles in the production hall is shown. The analysis was carried out taking into account key criteria such as the safety of the structure in operation and the overall reliability of the system. The results obtained indicate the importance of an integrated approach, where theoretical models and numerical simulations are combined with engineering experience in order to optimize the load-bearing capacity and long-term usability of the structure.

2. Description of the structure and selection of materials

One of the key steps in the development of a heavy-duty profile transmission assembly is the selection of the position and number of load-bearing elements. For the structure shown in Figure 1, four identical assemblies are used, which transmit a total load of a maximum of ≈1000 kg. The assembly is made of S235JR steel, while the supporting profiles are made as one-piece, i.e. they are cut from a 10mm thick board. The platform moves in two directions, that is, it lifts the load and transfers it to a certain position.

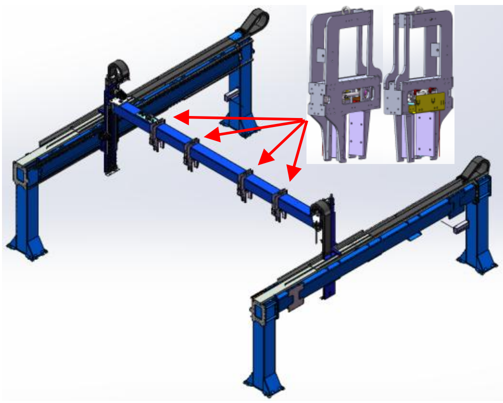

Fig. 1. Platform with 4 assemblies for receiving profiles

Table 1. Profile dimensions

Type	**Height** in mm	**Width** in mm
1	40	200
2	45	191
3	50	50
4	50	100
5	50	200
6	65	200
7	70	200
8	75	75
9	80	45

What is characteristic is that the cross-section of the profile that is transmitted varies (Table 1) and that this system is used to capture and hold when changing the position of the profile. The opening and closing of the assembly is realized by a pneumatic cylinder.

3. Results

During testing, it was taken into account that the complete load is transferred over the upper arms, and that the support on the sides serves as a support so that the complete assembly does not slip off the platform. The analysis includes the variation of the curvature radius at critical points in order to select the optimal geometry with identical load capacity for a constant arm thickness. Figure 2 shows the distribution of Von Mises Stress when transmitting loads, and the diagram (Figure 3) shows the results obtained for the defined load for different radius values. The deformation values are below the permissible limits for all flute analyses. During the test, the maximum and evenly distributed load on all four assemblies during transport was taken because the load is always purchased from the same place and placed in a precisely defined position.

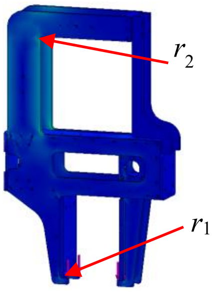

Fig. 2. Von Mises stress for load

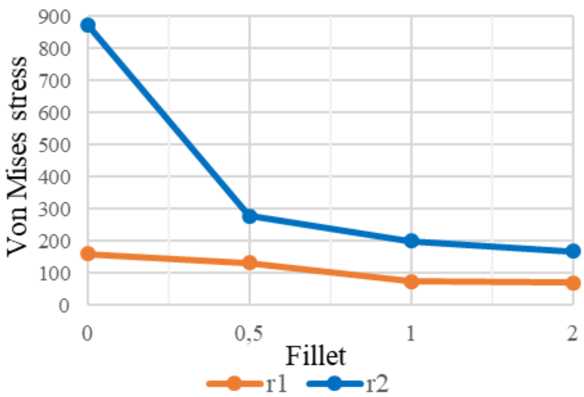

Fig. 3. Diagram of the change of Von Misses stress for different radius values.

4. Conclusions

Based on the results, it can be concluded that the radius of pain *r1* satisfies the defined loads, while the radius r_2 *less* than 1 mm does not meet the conditions and there would be a fracture on the arm. In order to meet the working conditions, and taking into account the loads and radii of the parts that are in contact with these parts, it was decided that the radius r_1 and r_2 should be made with the same values (Figure 4).

Fig. 4. Physical realization of assemblies in the production hall

The results in the exploitation process have shown that the assembly is very practical and satisfies the robustness and repeatability for different profile dimensions.

Acknowledgments

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