STABILITY ASSESSMENT OF HYDRAULIC CYLINDERS OF METALLURGICAL EQUIPMENT USING CAD AND CAE SOFTWARE

Taratuta K.V., Protsenko V. M., Vostotskyi S.M.
Zaporizhzhia National University, м. Zaporizhzhia

The aim of the study is to evaluate the stability of hydraulic cylinders of metallurgical equipment obtained by calculation and using computer design and calculation programs.

It is known that the mounting of a hydraulic cylinder affects its stability. Taking into account Euler's formula, it is clear that the stability is also influenced by the material properties (modulus of elasticity E) and geometrical characteristics of the section, expressed by the flexibility of the rod. It should also be noted that Euler's formula is applied in the elastic deformation zone. For the elastic-plastic deformation zone, the formula of F.S. Yasinsky is used. Specifically, for hydraulic cylinders of low and medium flexibility ($\lambda < \lambda$facet), the critical stresses are calculated according to the empirical dependence of F. S. Yasinsky.

For a more accurate determination of the critical stress, the differential equation of the beam is used, which also takes into account the frictional moment at the hinge.

The disadvantage of the above formulas is the availability of empirical values of flexibility depending on the material, as well as the availability of a limited list of values of the length reduction factor, which depends on the conditions of hydraulic cylinder fixing.

The analytical calculations obtained were compared with the calculation of the hydraulic cylinder model made in SolidWorks.

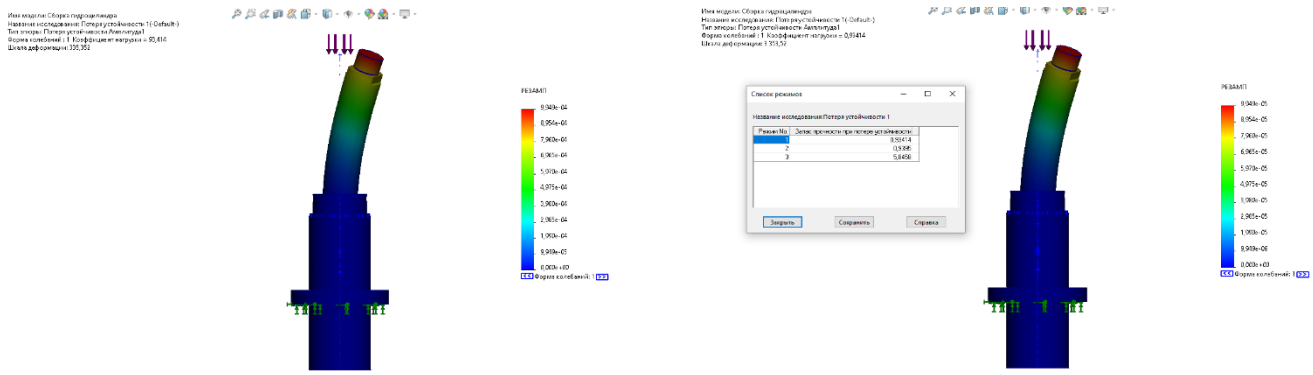

Figure 1 – Safety margin diagrams for loss of hydraulic cylinder stability

As a result, data was obtained that showed an increased safety margin for the specified operating conditions. Another advantage of using CAD and CAE software is the ability to adjust both the geometric parameters and the mounting of the cylinders and the material.

For example, the use of CAD and CAE software allows a more accurate determination of the safety margin of vertically mounted hydraulic cylinders and a reduction in weight through optimised mounting.