

APPLICATION OF NUMERICAL MODELING AND 3D ANALYSIS IN DESIGNING FLEXIBLE PRODUCT

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The article attempts to approximate the application of CAx software based on a selected mold made of rubber. The full technical preparation process of a given product for production requires taking various aspects at the construction stage. The correct geometric form of the mold product requires the adoption of the most optimal structural solution. This stage is the most responsible and requires a wide range of knowledge and practical skills. It is a complex process, often requires synergistic cooperation of specialists from various fields. That is why it is so difficult to launch a completely new product that will be competitive.

This article presents a practical form of implementation of the design process and numerical simulation by using professional engineering software. First, a geometric base model was adopted to determine the applicability of a given shape to the general material model and operational requirements. Several variants of 3D geometric models have been presented.

Then, the basic hyperelastic mathematical material model was adopted in the simulation program to reduce the gross solution error. In the simulation procedure the method of large deformations and the Newton-Rapson procedure were adopted. Procedures for optimizing the nodes and elements of the adopted discretized structure were also applied. Meshing was carried out using 3D tetrahedron elements with local densities in important places. Then, these models were subjected to 3D numerical analysis in the CAE program using the FEM.

The obtained results of numerous analyzes made it possible to approximate the most real form of deformations or loads. Based on them, the most favorable conditions meeting the basic performance criteria were selected. The further part consisted in the successive selection of appropriate material and dimensional properties of the designed 3D geometric model. Next, the most-advantageous design solution was proposed, which takes into account numerous criteria. The most important criterion was the minimization of production costs and the ease of release of the product from the cavities. Based on numerous numerical 3D modeling and simulation analyzes, a final version was proposed, which may be directed to the production stage. The initial production stage requires the use of a processing tool, which is an injection mold. The process of designing the injection mold goes beyond the scope of this article, so this issue in the smaller article is not discussed. However, at this stage, both moldmaker and product designers must work together to eliminate solution errors. It is important that the designer of the mold products knows the basics of such aspects as injection molding technology, design and operation of injection molds, materials for injection processing and their properties.

The article discusses the problems, identifies the phenomena and presents conclusions for practical application, which may be an indication for the implementation of similar projects.