

## APPLICATION OF AUTOMATED TECHNOLOGICAL COMPLEXES IN ADDITIVE PRODUCTION

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Many world manufacturers of products consider technologies and equipment of additive production (AP) as a means of obtaining the final product. AP provides an opportunity to implement innovative projects that in the past were considered impossible or unprofitable. Modern equipment and AP technologies are built on the layer-by-layer synthesis of products, but differ from each other by the materials used, the methods of creating and joining the layers among themselves. These differences determine not only the physical and mechanical properties of the material and the accuracy of the resulting shape of the product of the specified model, but also affect the manufacturing time, the need for finishing and the total cost of the product.

Among a wide variety of additive technologies, one of the most promising and least expensive directions is the layered formation of a model of sheet material (Laminated Object Manufacturing - LOM).

Scheme layered formation of products from sheet material is shown in the figure. It is based on the algorithm for breaking the computer model into layers. Cutting sheet material is carried out using modern automated systems.

The initial information for the product can be a solid model (when designing a new product), prepared in a graphic editor - Creo, KOMPAS 3D, SolidWorks, Unigraphics, etc. or a digital model obtained with the help of 3D scanners and coordinate measuring machines (when copying a standard).

At the next stage of production, the computer model of the product is rationally divided into layers of different thicknesses, according to a certain algorithm, which takes into account the possibility of cutting the edges at an angle.

After sorting layers by thickness, the contour of each layer is formed on an automated cutting complex. To program the contour to be processed, it is necessary to use the CAM (Computer Aided Manufacturing) module (Hypermill; Unigraphics; Turbonest, etc.), designed for the preparation of control programs for CNC-controlled machines. Writing the program code depends on the CNC system (Sinumerik; Fanuc; Heidenhain) used in the automated system. Programming is carried out using G-code.

The expanded sheet material (product layers) enters the subsequent layer-by-layer assembly, which can be performed in various ways, indicated on the diagram (figure 1) depending on the intended purpose of the product. If necessary, the product assembled for this technology can be further processed.

The final production cycle is the control of the mechanical and geometric parameters of the finished product.

The use of modern technological complexes with the automated control system makes it possible to prepare and cut edges along a curved path at an angle, which significantly reduces the number of product layers due to an increase in their thickness and reduces the need for subsequent processing of the resulting product.

To improve the quality and reduce the production time of non-separable products using LOM technology, it is advisable to cut and assemble the product using concentrated energy flows, which makes it possible to perform these operations on the same equipment while reducing interoperational time and transportation costs. All this affects the decrease in the final cost of the product.

Technological approbation on the basis of JSC "NPO Center" of the National Academy of Sciences of Belarus has shown that the use of modern technological complexes with the automated control system provides a transition to the application of additive technology of sheet cutting and assembly of products.

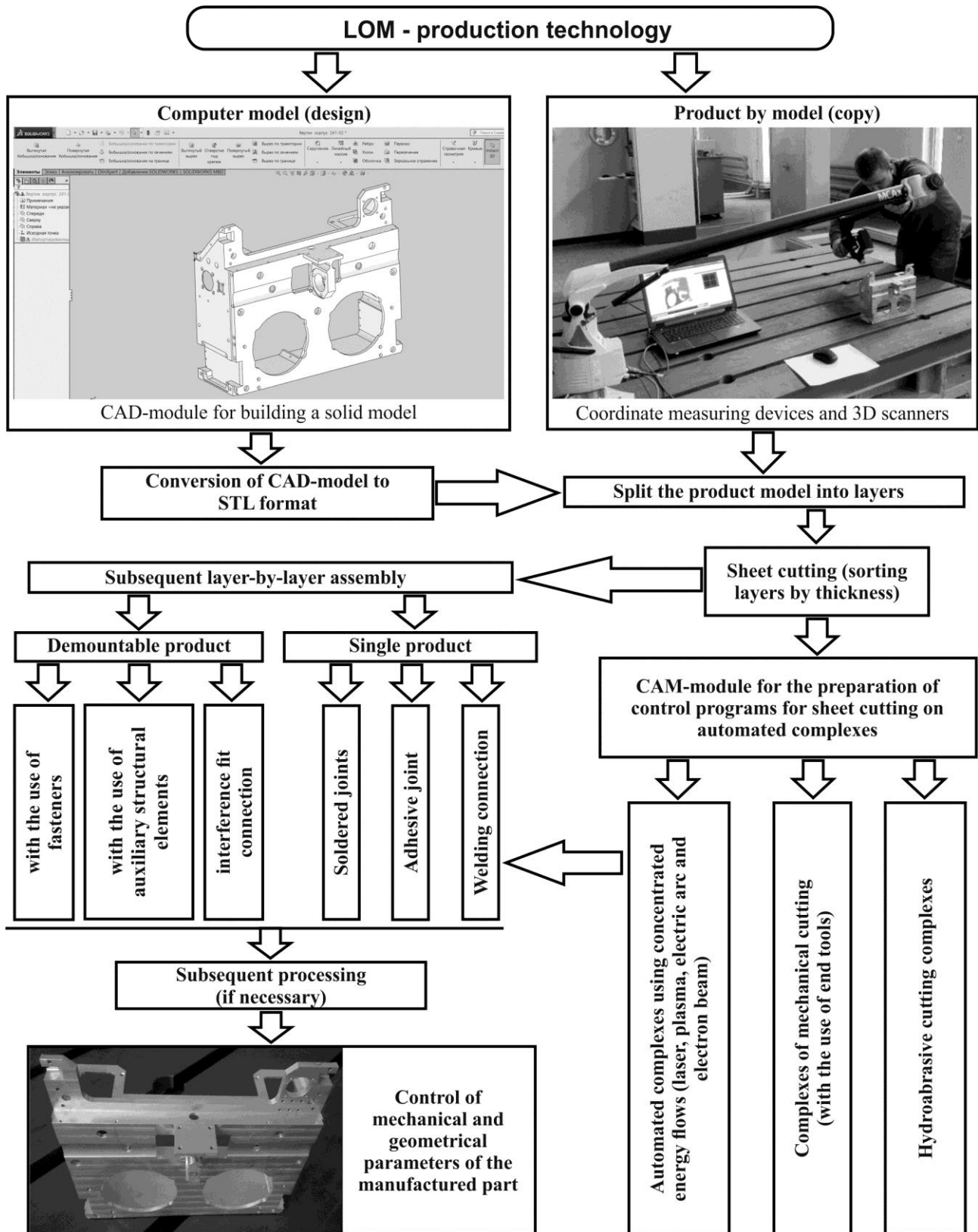


Figure 1. Scheme of additive production by the method of layered product formation

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