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MODELING AND NANOTECHNOLOGY

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RP (RAPID PROTOTYPE) TECHNOLOGY

***Abstract.** This article discusses rapid prototyping technologies and 3D modeling methods. Furthermore, the main purpose of this article is to more accurately describe the current relevance of rapid prototyping technologies and the areas in which it is applied. Most importantly, this article describes the working principles and methods of rapid prototyping.*

***Keywords:** Rapid prototype, CAD, CAM, FDM, Stereolithography, 3D printer, 3D computer modeling methods, SLS.*

The development of a new type of product is a long and arduous process that requires several stages of design and evaluation before mass production begins. 3D computer modeling methods, which are being established all over the world, will help to accelerate the passage of these stages. In addition, modern computer-aided design systems (CAD - computer aided design) significantly reduce the time and cost of developing and designing new products. However, for any complex product, the problem of creating a single physical image, or even a separate part of it, remains relevant. Currently, great advances are being made in the technology of layer formation of 3D objects. Such technologies are called Rapid Prototype (RP) technologies. Rapid prototyping (RP) is the creation of a physical sample of an

object from a CAD model using a 3D printer. RP technologies allow you to speed up the production cycle, significantly reduce product costs, work on a project, or make operational changes. Rapid prototyping began to evolve until the 1980s as a technology that could quickly transform digital designs into real objects. Prior to this technology, new product models were created by sculptors and artists. A new era of prototyping began with the development of the first 3D printing process. In 1984, American Chuck Hull received a patent for stereolithography (SLA - Stereo Lithography Apparatus) for rapid prototyping technology, i.e. the process of combining photopolymers using ultraviolet light (1). There are currently several RP technologies available:

- Stereolithography (SLA);
- Fused Deposition Modeling (FDM);
- Laser sintering of powdered materials (SLS - Selective Laser Sintering);
- Laminated Object Manufacturing (LOM).

SLA (Stereo Lithography Apparatus). Stereolithography is a 3D printing process that uses computer-controlled motion laser light, pre-programmed using CAM / CAD software.

CAD - computer-aided design.

CAM - computer production.

SLA is a fast prototype that requires the production of very precise and delicate details as well as special technology for project designs. It is used in the production of demonstration parts to validate concept ideas and to conduct ergonomic tests. Using an ultraviolet laser, the SLA transmits the shape of the model to the surface of the light vessel in series with the sensitive resin. Liquid plastic only hardens where the laser beam passes. A new layer of liquid, then flows over the solidified layer and the new contour is described by a laser. The process is repeated until the construction of the 3D model is complete.

In FDM (Fused Deposition Modeling) technology, a 3D object is created by selectively attaching the molten material superimposed layers in a predetermined path. The main materials used in FDM are thermoplastic polymers in the form of filaments.

SLS (Selective Laser Sintering) are an additive manufacturing (AM) technology for absorbing polymer powder particles into a robust structure based on a 3D model using a high-power laser. In this technology, 3D models are created with a sintering effective using laser light energy. Unlike SLA technology, laser beams are a source of heat, not a source of light. The laser beams incident on the thin powder layer sinter its particles and form a solid mass according to the geometry of the part.

LOM (Laminated Object Manufacturing) is an additive manufacturing technology that uses layered material. The production of objects by lamination involves the gradual bonding of paper, plastic or metal films. The contour is then created by laser cutting.

In conclusion rapid prototyping can reduce the time between iterations and allow engineers to discover inventive ways of solving any design engineering problems. RP can be used at any stage of the product development cycle, but is most effective early in the process so that risks can be mitigated early and designs can evolve more efficiently. Prototyping helps make educated, informed decisions by gathering data from the performance and reaction to the different prototypes.

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