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APPLICATION OF ADAPTIVE TECHNOLOGIES: ARTIFICIAL INTELLIGENCE IN AIRCRAFT MANUFACTURING

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Aviation industry is considered to be one of the most promising areas for the introduction of 3D technologies. Today, 3D design, 3D scanning and 3D printing play an important role in solving key tasks of this industry, such as: reducing the weight of aircraft, creating products with unique properties and complex geometry, reduction of the production cycle and costs, as well as saving materials and equipment. One of the brightest examples to testify to the relevance of this approach may be the VK-650V engine created using the latest technologies, electronic design and 3D printing of components [1], among others.

The use of 3D printers in aviation seems to be especially effective in the manufacture of prototypes, tooling and producing master models for casting. Vast opportunities also can be considered in the field of 3D printing of final metal products, which may soon become mass-produced.

Table 1.

Additive technologies and their application in aircraft manufacturing

Pros	*Cons*
Easy manufacturing of complex parts 3D kiln enables the creation of complex geometric shapes that are difficult or impossible to produce using traditional methods	*High costs* Metal 3D printing equipment is expensive and requires special training for staff and maintenance expenditures
Material savings Use of additive technologies produces minimal material waste which eventually saves resources	*Surface quality* Parts with 3D printing may have a rougher surface than traditionally manufactured parts
Fast development and production 3D printing allows rapid prototyping and testing of new designs, reducing the development time of new products	*Size restrictions* 3D metal printing has size limitations on manufactured parts, which can be a problem when creating bulky elements for the aviation industry
Customization 3D printing enables production of unique custom-made parts to suit specific needs of various aircraft samples and specifications	*Quality control* 3D manufactured parts need to be continuously monitored for quality due to possible defects that may occur during the 3D printing process.

Additive technologies provide a number of advantages over classical methods of creating aircraft parts, but they still have their drawbacks. Table 1 presented below showcases the list of merits and demerits to using this approach [2].

Despite the possible pitfalls, volumetric printing has the potential to revolutionize aircraft production by allowing parts to be manufactured on-site using industrial 3D printers, eliminating the need for transportation and large production complexes. This technology may be ideal for non-serial production as it requires minimal space and re-construction.

Artificial intelligence is actively used in many industries to increase profitability and reduce processing time. The contribution to the development of additive manufacturing is particularly noticeable. It becomes a key engine for the development of such important industries as the automotive industry, the aerospace industry and construction with an environmentally focused approach. The world scientific society is actively engaged in research on the use of artificial intelligence (AI) in 3D printing. The use of artificial intelligence (AI) in 3D printing is the subject of research all over the world [3, 4, 5]. In our opinion, serious improvement may be expected from the introduction of AI into these production processes using 3D modelling and additive technologies:

1. *Analysis and optimization of product design*: AI can help in the analysis and optimization of product design using additive technologies by analyzing the structure and materials, optimizing the shape and geometry of products, taking into account their functional requirements.

2. *Forecasting of production processes:* AI can be used to predict production processes using additive technologies (optimal process parameters such as temperature, speed and voltage) to achieve the best results.

3. *Quality control:* AI can be used to control the quality of manufactured products. It can monitor the production process, identify defects and errors and propose corrective measures to improve quality.

4. *Automation of the production process*: AI can help in automating the production process using additive technologies. It can control robotic systems, coordinate the operation of equipment and machines, and optimize production processes.

Thus, the use of AI may optimize the process of creating products in additive technologies, increasing the efficiency, quality and accuracy of production.

Conclusion

The prospects of using additive technologies with artificial intelligence in the aircraft industry are very encouraging. They may enable manufacturers to improve production processes, reduce the time and cost of manufacturing parts, as well as create more complex and lightweight structures. As a result they will increase the efficiency and cost-effectiveness of aviation systems. Thanks to the possibility of rapid prototyping, additive technologies may also contribute to innovation and the development of new concepts in the aircraft industry. Thus, the use of additive technologies will allow the aviation industry to become more competitive, modern and environmentally friendly.

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