

O.L. Voichyshen, postgraduate student of specialty 131 (Engineering Technology and Materials Science, 131A-23-10), CNC Programmer (RapidFit Company)
Scientific supervisor: V.A. Derbaba, Candidate of Technical Sciences, Head of Department of Engineering Technology and Materials Science
National Technical University "Dnipro Polytechnic", Dnipro, Ukraine

KEY ASPECTS OF ADAPTING LIQUID ROCKET ENGINE SHELLS MANUFACTURING TECHNOLOGY TO THE MODERN CAPABILITIES OF CAD-CAM SYSTEMS AND 5-AXIS CNC MACHINES

The following scientific results are described in the given article:

1. The planing [1] process using a special cutting tool on a 5-coordinate CNC machine for machining spiral surfaces of liquid engines shells has been proposed for the first time.

2. The principles of programming 5-axis CNC machines for planing using modern CAM-systems [2] have been developed for the first time.

3. A mathematical model of increasing the accuracy of the control program on a CNC machine [3] for processing the spiral surfaces of the shells of liquid rocket engines [4] has been obtained for the first time.

4. CAM-modeling of the cutting process to obtain the results of machining accuracy has been carried out.

The practical significance of the results described in the article:

1. Methods of programming 5-axis CNC machines for processing spiral surfaces of shells of liquid rocket engines by milling and planing methods were created and introduced into production.

2. Planing technology using a 5-axis CNC machine and a special cutting tool was introduced.

3. A system for measuring and analyzing the shells of liquid jet engines has been introduced into production.

4. A system for correction of the control program of a CNC machine tool has been created and implemented to increase the accuracy of processing the spiral surfaces of the shells of liquid rocket engines.

Theoretical and practical achievements of the work were implemented at the following enterprises: State Enterprise "Production Association Yuzhny Machine-Building plant named after A.M. Makarov" (YUZHMAH), State Enterprise "Yuzhnoye State Design Office named after M.K. Yangel" (YUZHNOYE SDO).

The introduction presents scientific novelty and practical significance, reveals the relevance of the study.

The main part analyzes the problems of manufacturing shells of liquid rocket engines in modern production, methods of their manufacture and control, substantiation and adaptation of the method of modeling the planing process for processing spiral surfaces of shells of liquid rocket engines. The method of programming 5-coordinate CNC machines for the planing process is described. The technique of control of accuracy at modeling of process of planing is offered.

The mathematical model of increase of accuracy of processing of spiral surfaces of covers of liquid rocket engines is developed, experimental researches on field samples with use of mathematical model are considered, methods of modeling and programming of process of planing for processing of spiral surfaces of covers of liquid rocket engines are developed. The results of using the above methods in production are considered.

In the general conclusions recommendations of practical use of the developed methods and results are offered and results of theoretical and experimental researches are summarized.

References:

1. Planing (process) URL: [https://en.wikipedia.org/wiki/Planing_\(shaping\)](https://en.wikipedia.org/wiki/Planing_(shaping))
2. CAM-system URL: <https://www.autodesk.com/products/fusion-360/blog/computer-aided-manufacturing-beginners/>
3. CNC machine URL: <https://cncmachines.com/what-is-a-cnc-machine>
4. Liquid rocket engine URL: <https://www.grc.nasa.gov/www/k-12/airplane/lrockth.html>