TECHNICAL DESIGN OF THE MACHINING PROCESS OF PARTS ON CNC MACHINES USING 3D SOFTWARE

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The automotive industry has witnessed significant advancements in recent years, particularly in the production of high-precision powertrain components. The performance, reliability, and durability of engines and transmissions depend on the dimensional accuracy and surface quality of individual parts. Consequently, the technical design of machining processes plays a vital role in modern manufacturing. A critical aspect of machining design is the proper selection of workpieces. The characteristics of the initial blank, including its geometry, material, and size, significantly impact machining efficiency and quality. Selecting appropriate blanks reduces material waste, shortens production cycles, and decreases overall manufacturing costs. The integration of 3D CAD/CAM software has revolutionized process design. Engineers can create precise digital models, simulate machining operations, analyze tool paths, and optimize cutting parameters. These virtual simulations allow the identification and correction of potential issues before production, ensuring higher efficiency, reduced costs, and consistent quality, particularly in high-precision sectors such as UzAuto Motors Powertrain. Digital technologies in machining design have become indispensable. Traditional methods relying on manual calculations and trial-and-error approaches cannot meet today's industrial standards for accuracy and efficiency. For UzAuto Motors Powertrain, which manufactures engine and transmission components with complex geometries and strict tolerances, the use of 3D software offers several advantages. Simulation predicts deviations before machining. Material usage is minimized, and waste is reduced. Machining cycles are optimized through preplanned tool paths. Fewer reworks and lower scrap rates. Machining sequences can be refined to maximize efficiency. Thus, studying the technical design of machining operations with 3D software is both academically and industrially relevant, contributing to technological innovation and competitiveness. To develop a systematic methodology for designing machining processes on CNC machines using 3D software to enhance precision, efficiency, and quality of powertrain components. Analyze the technological requirements of powertrain components at UzAuto Motors. Investigate the capabilities of 3D CAD/CAM software for machining process modeling. Design optimized machining processes to reduce errors, waste, and time. Simulate and evaluate process efficiency through virtual environments. Propose practical guidelines for industrial implementation. Recent research highlights the advantages of 3D CAD/CAM integration in machining. Digital simulations enhance precision by providing real-time visualization of tool paths and identifying potential

collisions. Additionally, optimized workpiece selection and fixture design contribute to stability during machining, preventing vibration and inaccuracies. Such approaches improve efficiency, reduce material waste, and ensure high-quality output, confirming the importance of digital methodologies in modern manufacturing. The study employs both theoretical and practical approaches. Review of technical documentation, machining standards, CNC machine capabilities, and material properties. Creation of 3D models of components and simulation of machining operations in CAD/CAM software. Analysis of tool paths, cutting parameters, and simulated outcomes to assess material usage, surface quality, and dimensional accuracy.

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