

## Practical aspects regarding optimization of three axis CNC machining

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**Abstract.** In CNC machining, optimizing the manufacturing process is essential for reducing costs and increasing efficiency. This article presents practical methods for optimizing G-code using CNC simulation and optimization software. The study focuses on analyzing an existing CNC program created for a Doosan CNC machine, with the primary goal of reducing machining time and optimizing tool paths. The optimization process involves identifying inefficiencies within the original G-code and implementing improvements through various strategies. The most significant modifications include adjusting the feed rate, increasing the depth of cut, adopting adaptive machining strategies, and eliminating unnecessary movements from the G-code. These changes aim to enhance machining performance while maintaining the quality and accuracy of the final product. At the final stage, the optimized data is presented, demonstrating a notable improvement. Specifically, the machining program shows a reduction in processing time by approximately three minutes compared to the initial version. This enhancement translates into increased productivity and more efficient resource utilization. Additionally, the study highlights the importance of continuous analysis and optimization to further improve CNC machining processes.



## References

- [1] Frăţilă, D., Radu, A., Păcurar, A., Păcurar, R., Conţiu, G., Panc, N., & Pop, G., Tehnologii de fabricaţie, 2020.
- [2] But, A., & Mazuru, S., "Serghei Scaticailov: Fabricaţia asistată de calculator," Universitatea Tehnică a Moldovei, Chişinău: Tehnica-UTM, 2021.
- [3] But, A., & Scaticailov, S., "Using CAM software to improve productivity," IOP Conference Series: Materials Science and Engineering, vol. 564, no. 1, p. 012055, 2019.  
<https://doi.org/10.1088/1757-899X/564/1/012055>

- [4] Lysek, K., Gwiazda, A., & Herbus, K., "Application of CAM systems to simulate milling machine work," IOP Conference Series: Materials Science and Engineering, vol. 400, no. 4, p. 042037, 2018. <https://doi.org/10.1088/1757-899X/400/4/042037>
- [5] Dodok, T., Čuboňová, N., Císar, M., Kuric, I., & Zajačko, I., "Utilization of strategies to generate and optimize machining sequences in CAD/CAM," Procedia Engineering, vol. 192, pp. 113-118, 2017. <https://doi.org/10.1016/j.proeng.2017.06.078>
- [6] Bîcioc, M., "Technological assurance of mechanical processing of complex shaped parts based on machining centers with numerical control," Journal of Engineering Sciences, no. 3, pp. 8-17, 2024.
- [7] Bîcioc, M., "A case study of the tool paths strategies applicable for milling complex surfaces on three coordinates CNC machines," Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering, pp. 505-512, 2024. <https://doi.org/10.24136/atna.2024.212>
- [8] Mazuru S., Scaticailov S. New technological solution for manufacturing precessional gears with non-standard profile. Acta Technica Napocensis. Series: Applied Mathematics, Mechanics, and Engineering. Vol. 66, No 5, October, 2023. <https://doi.org/10.24136/atna.2024.212>.
- [9] Bostan I., Mazuru S., Scaticailov S. Processes generating non-standard profiles variable convex- concav of precessional gear. Journal of Engineering Sciences and Innovation. Volume 5, Issue 2 / 2020.
- [10] Bostan I., Mazuru S., Scaticailov S. Technologies for precessional planetary transmissions toothing generation. TEHNOMUS jurnal. Nr. 20. 2013
- [11] Botnari Vl., Mazuru S. Influence of Processing Parameters on the Quality of the Superficial Layer after Processing Surfaces with Plastic Deformation Processes. Applied Mechanics and Materials Vol. 657. 2014.
- [12] Stroncea A., Toca A., Nitulenco T. Considerations regarding the optimal dimensional design of machining technologies. Acta Technica Napocensis. Series: Applied Mathematics, Mechanics, and Engineering. Vol. 66, Issue Special II, October, 2023.
- [13] Toca A., Stroncea A., Stingaci I., Rusica I. Synthesis of optimal dimensional structure of the technological processes of machining. IOP Conf. Ser.: Materials Science and Engineering 400, United Kingdom, 022054. 2018.
- [14] Toca A., Iațchevici V., Nițulenco T., Rusu N. Some aspects of technology transfer. MATEC Web of Conferences 178, France, 08006.2018.