MANUFACTURING AND GEOMETRY MEASUREMENT OF PARTS WITH FREE FORM SURFACES

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Abstract

Based on several years of research at the Department of Production Engineering, Faculty of Mechanical engineering, University of Belgrade, Serbia, software for automatic tool path generation for parts with free form surfaces has been developed. Using this software, a tool path for machining of different parts with free form surfaces was generated. The main goal of the conducted research was to generate a tool path with minimal machining time whilst not compromising the machining quality. A multicriteria tool path optimization method was used, in particular the feed rate variation method, in order to obtain a control code (NC) that would allow machining with constant cutting force. Manufacturing of the parts was done at the Mechanical Engineering Faculty in Belgrade, using the ILR HMC 500/40 tool system, according to generated control codes. During the manufacturing it was concluded that the machining of these parts was performed with constant cutting force. Geometrical measurements of manufactured parts were performed at the Department of Physics - University of Liverpool, UK using OGP Smartscope CNC 624 multisensor metrology system. The measurements of the manufactured parts were performed using two methods; contact (touch probe) and contactless (optical) whereby a point cloud of data was obtained. Using the MATLAB® software package, a program code was written that generates a map of the deviation based on the difference between the loaded point cloud and the CAD model. Finally, by analysing generated maps of deviation, it was concluded that the machining was performed within defined specifications. This demonstrated that the developed system is a useful for tool path generation for parts with free form surfaces.

Keywords

Computer graphics, CAD/CAM systems, Free form surfaces, Tool path optimization, Map of deviation

Acknowledgement

The author wishes to thank the Ministry of Science and Technological Development of Serbia for providing financial support that made this work possible (Project TR 35022). We are also very thankful to people from University of Liverpool, Department of physics – Particle Physics Group and DESY for excellent collaboration and all the help in finalizing this project.