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Develop the path planning system for a B-axis fixed plane on a 4-axis machine tool

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In this paper, a path planning system for B-axis is developed for a 4-axis turn-mill multitasking machine. Due to the lack of B-axis, the features on a tilt plane are difficult to be machined; this research developed value-added software to solve above issues. Extending the machinability of a CNC multi-axis machine tool can be achieved without increasing cost, this research uses homogeneous coordinates to transform the existing 3-axis machining path which planned in the system into a tilt fixed plane machining path. In addition, the theoretical formula of bottom surface roughness is derived from the research, and C programming language and Visual Studio platform are utilized to complete the development of HMI (Human-Machine Interface). Four machining paths and the prediction of roughness are the main features for this tilted plane machining software. The HMI is primarily presented in a dialog form so that the users have a simple operating environment which is a low threshold of technique. This software is mainly used in aerospace, automobile, and precision machinery industries. Set each machining path into a path-function of C language, and set homogeneous coordinate matrices into a method of C language to apply to each coordinate point. In order to transform a horizontal plane to a tilt plane, the program needs the rotation matrix by the world Y-axis and the rotation matrix by the current X-axis. Also, the prediction of roughness is derived from the bottom milling. Verification of the software which is developed in this research is done through NcPlot, Vericut, and AutoCAD, by testing the accuracy of the path of the exported program, the accuracy of the path is less than or equal to 1 μm. In order to enhance the practicality, researcher derives a new formula for predicting the surface roughness, the rate of error for predicting is less than 10%. Finally, the speed of generating machining code is 92.8% faster than a traditional method.

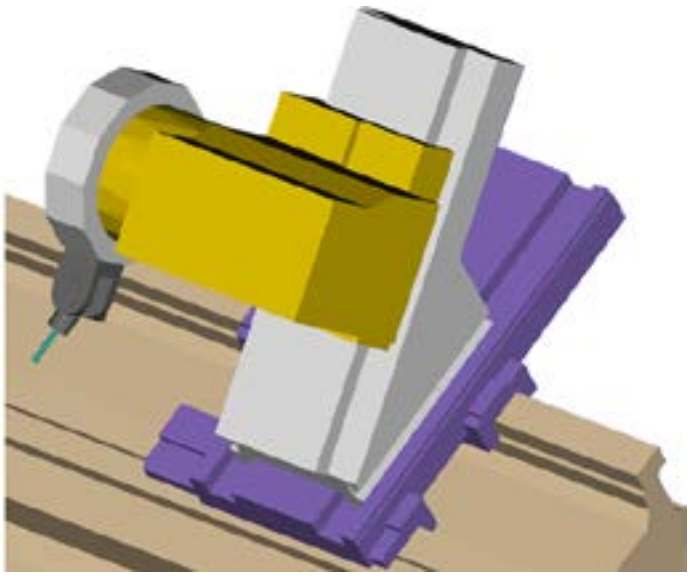

Fig. 3D diagram of Non-Orthogonal machine structure

Notes:

Recent Publications

1. Ahmad Z, Rahmani K and D'souza R M (2010) Applications of genetic algorithms in process planning: tool sequence selection for 2.5-axis pocket machining. J Intell Manuf. 21(4):461–470.
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4. Bala M and Chang T C (1991) Automatic cutter selection and optimal cutter path generation for prismatic parts. Int J Prod Res. 29(11):2163–2176.
5. Ben Shneiderman (2009) Designing the User Interface: Strategies for Effective Human-Computer Interaction. USA: Prentice Hall. ISBN: 9780321537355.

Biography

Hao-Ting Lin is an Assistant Professor of Mechanical and Computer-Aided Engineering, Feng Chia University and he received his PhD degree from National Taiwan University in 2012. Between 2013 and 2015, he was a Postdoctoral Fellow in Graduate Institute of Oral Biology and Department of Engineering Science and Ocean Engineering in National Taiwan University. In 2015, he began as an Assistant Professor in Feng Chia University in Taiwan. His research interests include Dynamics Analysis and Simulation, Robotics, Mechanical Design and Analysis, Microfluidic Application, Bioengineering and Medical Device.

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