Interference-Free Tool Path Generation for Additional-Four-Axis Machining

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Abstract

Additional-Four-Axis (AFA) machine is an enhanced three-axis-machine to which a rotational axis is attached. With this machine, part family (called *rotational-free-surface* or RFS) requiring concurrent motions for the tool movement and part rotation, can be machined. Previously, we developed a four-axis CAM system consisting of RFS geometric modeler, CL-data generator, graphic simulator, and postprocessor so that the complete NC process from part design to machining can be done on a computer. As far as CL-data is concerned, our previous algorithm was not capable of dealing with the tool interference problem. Although many research results were reported on the tool interference problem, they are difficult to apply for the additional-four-axis machining due to the difference in machining configuration.

In this paper, we develop an algorithm for generating interference-free tool paths for additional-four-axis machining in which three types of interference exist: a) Tool body interference, b) Ball interference at valley, and c) Ball interference at hill. Consideration of

the three types of interference (easpecially type a) are important to manufacture RFS parts with accuracy. The algorithm is largely composed of two functions: a) Detection of the type of interference, followed by b) Modification of the interfered path. To test the validity and difference of the algorithm, many graphic simulations and testcuts are performed and compared for the RFS parts (regular parts) used in our previous CAM system. Additional simulations and testcuts are carried out to show the validity of the interference-free algorithm for the irregular RFS parts.

Keywords: Four-axis Machining, Interference-Free Tool Path, Rotational Parts, Computer Numerical Control, CAM, Automated Machining