Accuracy enhancements for CNC motion control through algorithms based on analytic path geometry

Rida T. Farouki

Abstract

Modern computer numerical control (CNC) systems for machining, layered manufacturing, composites fabrication, inspection, and related processes typically employ crude and data–intensive geometrical path descriptions, that entail severe information loss when addressing problems such as the suppression of positional errors due to physical machine limitations, or the specification of tool orientation relative to a surface normal. Results from several recent studies aimed at circumventing this problem are presented, including experimental verification from implementations on a CNC machine with an open–architecture controller. These encompass real–time compensation for axis inertia and damping through an inverse–dynamics algorithm; cross–coupled control based on precise real–time measurement of path contour error; and optimal specification of tool orientation in 5–axis CNC machining.

References

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Rida T. Farouki
Department of Mechanical and Aerospace Engineering,
University of California, Davis, CA 95616, USA