Abstract

This paper presents design and implementation of a 2 axis Circular Interpolation Controller in a Xilinx Spartan 6 FPGA to control a 2D Circular motion of a CNC machine or robotic arm. It is implemented using Verilog HDL. Circular motion like linear motion is one of the fundamental movement and an absolute necessity for any motion controller. High precision, repeatability and direction-independent are the three important factors to evaluate the performance of circular interpolation algorithm. To achieve this, a novel analogy Digital Differential Analyzer (DDA) algorithm based circular interpolation controller is implemented, which avoids complex on-the-motion computation with skillful combination of the accumulator and multiplier based hardware structure of FPGA. Hence the real-time performance and precision are enormously improved. The principle of algorithm and its hardware implementation with macro and micro architecture design are discussed in detail in the paper. The simulation results verify the excellent performance and effectiveness of implemented circular interpolation controller.
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**Index Terms**

Computer Science  
Artificial Intelligence

**Keywords**

CNC  Circular interpolation  DDA  Motion Controllers  FPGA  UART