加拿大英屬哥倫比亞大學製造自動化實驗室控制技術研發現況

Machine Tool Control Technology Developed at UBC-MAL

Yusuf Altintas
Professor The University of British Columbia Manufacturing Automation Laboratory Vancouver – Canada

Alexander Yuen
Ph.D. Candidate The University of British Columbia Manufacturing Automation Laboratory Vancouver – Canada

關鍵詞(Keywords)

- 虛擬控制器　Virtual CNC
- 虛擬切削　Virtual Machining
- 精微加工　Micromachining

摘要(Abstract)

加拿大英屬哥倫比亞大學製造自動化實驗室自 1986 年起開始發展金屬切削力學、工具機振動理論、虛擬切削、工具機監控與控制系統。本文以 9 軸 CNC 工具機為例，介紹本實驗室的研發現況。

The Manufacturing Automation Laboratory (MAL) at the University of British Columbia has been conducting research in metal cutting mechanics, machine tool vibrations, virtual machining, machine tool monitoring and CNC system design since 1986. This article presents the highlights of our research activities in multi-axis machine tool including Virtual CNC and a novel, 9-axis precision micromachining center.

Introduction

MAL has developed a virtual CNC design kit that allows automatic configuration of any 5 axis serial kinematic machine tool driven by linear or ball screw drives. The virtual CNC has been developed in MATLAB Simulink environment where the user can define the kinematic configuration of the machine; select drives with their friction, structural properties

including its vibration characteristics, and velocity – acceleration – jerk limits; trajectory profiles which include the shape of velocity changes along the path; splining motion along the multi-axis curved paths; compensating future contouring errors by predicting them few hundred blocks ahead and compensating them; selecting various control methods for high precision tracking with friction compensation and active damping of vibrations; and compensation of position dependent and position independent volumetric errors of machine tools. Virtual CNC predicts the total machining time for the part, and all the states at the servo sampling intervals, such as position-velocity-acceleration-jerk-motor torque – tracking error on each drive as well as the contouring errors left on the part due to CNC dynamics. When the Virtual CNC is connected to a digital signal processing board with a real time operating system with MATLAB to C converter/compiler, it automatically becomes a real CNC to control physical machine tools.

UBC MAL's CNC is used to conduct basic research, teach CNC design to students and demonstrate the new methods to industrial clients for technology transfer and licensing. The features of the CNC are outlined as follows.

Modular Virtual/Real Time CNC

Virtual CNC has five major modules as shown in Figure 1: Axis configuration, Tool Path input, Trajectory Generation, Axis Control, Simulation and Real Time CNC.

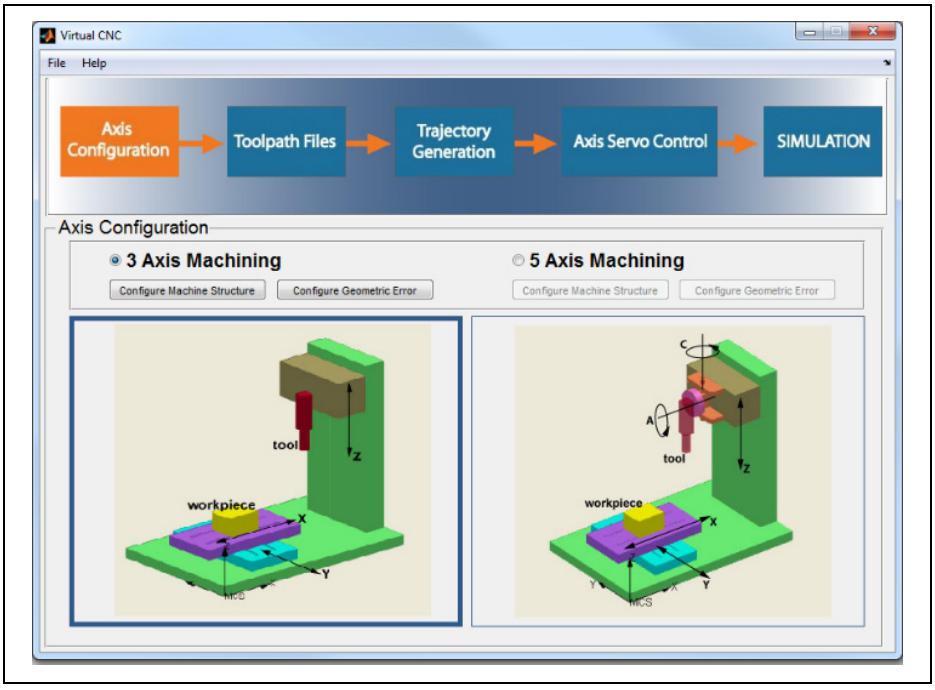

Figure 1
Virtual CNC Architecture.

更完整的內容

請參考【機械工業雜誌】404 期・105 年 11 月號

每期 220 元・一年 12 期 2200 元

劃撥帳號：07188562 工業技術研究院機械所

訂書專線：03-591-9342

傳真訂購：03-582-2011

機械工業雜誌官方網站：www.automan.tw

機械工業雜誌信箱：jmi@itri.org.tw