综合报告会

Lecture

国家数学与交叉科学中心

Time: 10:30 am, November 5, 2011
Venue: Institute of Computational Mathematics, Room 311

Virtual High Performance Machining

Speaker: Prof. Yusuf Altintas

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NSERC – P&WC Industrial Research Chair Professor in Virtual Machining
Fellow of Royal Society of Canada, CIRP, ASME, SME,CAE, P&WC

Abstract:

Our research in the areas of mechanics and dynamics of milling processes, machine tool control, precision turning, and design of CNC systems will be summarized in the seminar.

The focus of the metal removal research is to analyze the mechanics and dynamics of metal cutting operations. Comprehensive time domain and analytic models have been developed to predict cutting forces, dimensional errors and chatter vibrations for milling operations. The geometry of end and face milling cutters are generalized and represented by a common geometric model. The cutting pressure at any oblique point along the cutting edge is predicted by oblique transformation of shear stress, shear angle and friction coefficient of workpiece material obtained from orthogonal cutting experiments. The influence of structural vibrations between the cutting tool and workpiece are integrated to the true kinematics model of milling process. The cutting mechanics, rigid body kinematics of milling, static and dynamic deformations are incorporated to a unified mathematical model. In addition, a novel analytical chatter stability theory has been developed for milling operations. The models have been integrated to a novel Virtual Machining System which can simulate and optimize the part machining operations in CAM environment. The software can predict cutting forces, torque, power, tool and chip temperature, dimensional surface errors, tool and workpiece vibrations, and chatter free cutting conditions.

The presentation will cover the basic structure of an in-house developed Virtual CNC system. The architecture allows rapid reconfiguration to control other machine tools and machining processes using script commands. Sample algorithms for high speed feed drive control, trajectory generation and adaptive cutting process control will be presented.

The talk will conclude by presenting our current research on high speed spindle design and analysis, multibody dynamic model of machine tools, micro-machining and active vibration damping of machine tools.