MAL Manufacturing Automation Laboratories, Inc. 2829 Highbury Street Vancouver, B.C. Canada V6R 3T7

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www.malinc.com

A Short Practical but Advanced Training Course...

On – Line "Machining Process Modeling, Machine Tap Testing and Chatter Vibrations Avoidance - ShopPro/CutPro"

Date: October - November 2020.

Instructor: Prof. Y. Altintas

Five Weeks long On – Line Training, 90 minutes long- 4 sessions per week

Fee: US\$4000 per attendant. Mal Inc. will provide lecture notes, CUTPRO, ShopPro and MACHPRO licenses during the course period for free use by the attendants. The fee without the temporary software licenses (i.e. current license holders of all software products): US\$3500.

Objective: UBC Manufacturing Automation Laboratory has developed advanced, easy- to-use machining process simulation and measurement software which is used by a number of companies around the world. ShopPro is an integrated, easy to use tap-testing, chatter stability lobe, torque, power prediction as well as giving expert advice to solve machining problems. CUTPRO is advanced software with milling, turning, boring, drilling, spindle, CNC, tap testing, modal analysis and data acquisition modules. Machining process simulation modules predict forces, torque, power, bending moment on spindle bearings, dimensional surface finish, vibrations and chatter-free depths of cut and spindle speeds. Machine tool and cutting tool designers can optimize their design choices, while process planners can significantly reduce the machining time while maintaining the accuracy and quality of the parts. The course gives balanced training of basic machining principles and their hands on application on machine tools.

Requirements: Machining experience with engineering or technologist training. Book "Manufacturing Automation, Y. Altintas, Cambridge University Press (~US\$70), PC Computer.

Week 1: Material testing for machining process modeling

Period	Content	Activity
Lecture I	Orthogonal cutting model: shear stress - shear angle-friction/lubrication; cutting constants	Lecture by Prof. Altintas
Tutorial I	Material data base design from cutting tests (Manual calculations)	Mal Inc. Engineer
Lecture II	Oblique cutting model: turning, drilling, milling. Cutter design with CutPro	Lecture by Prof. Altintas
Tutorial II	CUTPRO : Implementation of turning, milling, drilling simulations	Mal Inc. Engineer



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Week 2: Machine tool testing

Period	Content	Activity
Lecture III	Practical fundamentals of tool/workpiece vibrations; frequency measurement of tool/workpiece; engineering interpretation of tap test measurements	Prof. Altintas
Tutorial III	Manual calculations, CutPro/Modal Analysis)	Prof. Altintas and MAL Inc engineer
Lecture IV	Hammer tests to measure FRF (frequency response function) of the machine tool (Manual calculations, MalTF/Modal Analysis)	Prof. Altintas
Tutorial IV	Modal analysis, hands on training and the engineering interpretation of mode shapes for troubleshooting machine and fixture setups	Prof. Altintas and MAL Inc engineer

Week 3: Chatter stability lobes and chatter avoidance in machining

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Period	Content	Activity			
Lecture V	Construction of Chatter Stability Lobes using simple theory	Prof. Altintas			
Tutorial V	Manual construction of Chatter Stability Lobes for turning operations	Prof. Altintas and MAL Inc engineer			
Lecture VI	Advanced Chatter stability for milling, boring heads and drilling	Prof. Altintas			
Tutorial VI	Chatter stability for milling, boring heads and drilling	Prof. Altintas and MAL Inc engineer			



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Week 4: Project Week

Period	Content	Activity
Lecture VII	Analyze actual cutting, discussion of results and the influence of tool geometry, material properties and machine tool dynamic stiffness on chatter (Manual calculations)	Prof. Altintas
Tutorial VII	Practice design of milling operation, conduct virtual tests, analyze the results	Prof. Altintas and MAL Inc. Engineer
Lecture VIII	Variable pitch cutter design; effect of run – out, serrated cutter, frequency and time domain based stability, process damping	Prof. Altintas
Tutorial VIII	Practice with advanced features of CUTPRO	MAL Inc. Engineer

Week 5: Machining diagnostics and virtual machining

Period	Content	Activity
Lecture IX	Introduction of CAM Based Part Machining Simulation and Optimizatoin: MACHPRO, NPRO (NX) and DELPRO (CATIA)	Prof. Altintas and MAL Inc. Engineer
Tutorial IX	Hands on training of MACHPRO	MAL Inc. Engineer
Lecture X	Virtual CNC and Current research and developments at UBC Manufacturing Automation Laboratory.	Prof. Altintas
Tutorial X	Hands on training: NPRO, MACHPRO and CATIAL DELPRO	Lab Assistants/ Prof. Altintas