科技部中部科學工業園區管理局

強化區域合作推動中南部智慧機械及航太產業升級輔導推廣計畫

智慧機械與航太產業創新創業論壇

「智能化製造技術」論壇

振動是精密機械與製造上必須面對與克服的問題，於多數高科技產業，成品的好壞需透過可靠度、耐久性的測試與量測來驗證，本論壇邀請到世界知名的振動領域大師 Ewins 博士來分享他的經驗，Ewins 博士擔任過世界知名航太與國防科技公司顧問，協助解決許多問題，此次演講將透過如航太、機械、飛彈等案例分享，來講解如何進行智慧化動態測試與驗證。同時也邀請了國內十分著名的鄭志鈞特聘教授來分享如何藉由智慧化技術來改善工具機機台性能，鄭教授長期與國內工具機產業進行智慧化方面研究，因此演講內容有相當應用價值。

主辦單位：中部科學工業園區管理局
承辦單位：中興大學智慧機械及航太產業升級輔導推廣計畫辦公室、工研院智慧機械科技中心
協辦單位：台灣中部科學園區產學訓協會
舉辦日期：107 年 09 月 25 日（二）下午 13:00 – 16:20
舉辦地點：中部科學工業園區管理局行政大樓 401 會議廳（臺中市西屯區中科路 2 號 4 樓）
報名時間：即日起至 107 年 09 月 21 日中午 12:00 前 (額滿為止)
報名網址：https://goo.gl/forms/R7z857fVSNr0dLQA3 **或Email/電話與計畫辦公室聯絡**

智慧機械與航太產業創新創業論壇		
時間	**主　　題**	**演講者**
12：50-13：20	**報到**	
13：20-13：30	**開幕致詞**	**中科管理局長官與貴賓**
13：30-15：00	**Smart Dynamic Testing for Verification, Certification and Endurance Qualification** (現場有摘要中文口譯,中興大學機械系陳任之教授)	**David Ewins 教授** **英國皇家學會院士（FRS）、皇家工程院士（FRAEng）**
15：00-15：20	**Tea time**	
15：20-16：20	**Smart Linear Guideways Preload Monitoring And Stable Machining Techniques for Machine Tools** （中文演講）	**鄭志鈞 特聘教授** **國立中正大學機械工程學系**

註1：本研討會全程免費，提供茶點，歡迎有興趣人士報名參加
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註2：地下停車場為車牌辨識進入，請參考附件。

講師與講題簡介

◆ David Ewins 教授

David Ewins 教授為英國皇家學會院士（FRS）、皇家工程院士（FRAEng），曾為英國倫敦帝國學院振動學講座教授，並曾擔任該校國際事務副校長及多國大學之訪問教授。Ewins 教授之主要研究方向為振動學、實驗模態分析及轉子動力學，其著作「Modal Testing: Theory and Practice」為相關領域之權威參考書。

Ewins 教授除在實驗模態分析領域外，亦長期研究飛機引擎之結構動力學。從 1990 年起，他即與勞斯萊斯飛機引擎公司（Rolls-Royce plc，RR）合作，於帝國學院成立 RR 之首批大學科研中心（University Technology Centre, UTC），每年受 RR 公司資助達五十萬英鎊（約二千萬新台幣）。Ewins 教授於 2007 年轉往布里斯托大學（University of Bristol）擔任研究中心主任，並與 AugustaWestland（英規阿帕蒂直升機之廠商）簽訂為期四年之 UTC 合作合同，總額達二百萬英鎊（約八千萬新台幣）。

演講摘要

Smart Dynamic Testing for Verification, Certification and Endurance Qualification

In many high-technology industries where structural integrity is a primary requirement - such as Aerospace Defence and High-performance Power Generation - physical testing to demonstrate endurance, reliability and maintenance of functional performance is mandatory. Endurance tests are conducted in advance of actual service life to verify these critical features. These tests have been conducted in much the same way for decades and it is well know that they are often less reliable than is needed. Vibration levels under test conditions can be orders of magnitude higher, or lower, than those experienced in service. Recent developments – described in this talk - in which theoretical models of the test structure and setup are used to enhance the actual test, have led to a dramatic reduction these large discrepancies. An unexpected benefit from these advances is a considerable reduction in the cost of the actual testing.

◆ **鄭志鈞 特聘教授**

Dr. C. C. Cheng is currently distinguished professor of Department of Mechanical Engineering at National Chung Cheng University (CCU). He received his 1985 B.S. from National Cheng Kung University, 1990 MS and 1994 Ph.D. from North Carolina State University (USA). He worked as Adjutant Professor in Dept. of Mechanical and Nuclear Engineering at Pennsylvania State University (USA) in 2005, and Chairman of Department of Mechanical Engineering at National Chung Cheng University (CCU) from 2009 to 2012. He now serves as an associated editor of Journal of the Chinese Society of Mechanical Engineers and reviewer for many Journals, such as Journal of Vibration and Acoustics, ASME, ASA, Journal of Sound and Vibration, etc. His industry background has included the work in General Electric Co. (USA) and Ford Motor Co. (USA). He also serves as technical consultant of several machine tool companies in Taiwan.

Dr. Cheng's technical interests lie in the areas of structural acoustics, vibration, smart sensing and machine health diagnosis and prognosis. He has authored in excess of 90 professional articles including archival journal papers and professional conference articles in these areas.

演講摘要

Smart Linear Guideways Preload Monitoring And Stable Machining Techniques for Machine Tools

Two smart techniques based on operational modal analysis (OMA) applied to machine tools are introduced. The first one is a novel methodology for automatically monitoring preload degradation of linear guideway type (LGT) recirculating linear ball bearing of an X-Y table. The second is a stable machining technique using adaptive spindle speed, where the spindle speed is adjusted optimally according to an on-line machining stability analysis.

By simply attaching three accelerometers on the worktable of a machine tool and then exciting the worktable with a pulse from servomotor, the worktable natural frequencies and the corresponding mode shapes are identified based on the method of OMA. It is found that the worktable yawing mode is most sensitive to the LGT linear bearing preload change and is selected to be the target frequency. By tracking the change of this specific natural frequency with modal assurance criteria (MAC), the LGT linear bearing preload degradation can be on-line monitored automatically without taking off the worktable.

A stable machining technique is introduced as the second applications of OMA. With two accelerometers attached on the spindle, the dynamic characteristics, i.e. the natural frequency and the associated damping corresponding to the spindle-tool system coupled with the cutting impedance, are identified during the machining process using the OMA. With this information, the stability lobe diagram (SLD) which determines the optimal spindle speed is obtained and then the spindle speed is on-line adjusted accordingly. This proposed adaptive spindle speed machining technique is integrated with CNC controller and its performance in machining is assessed experimentally.

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