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Summary

TEACHING

I have had opportunities to teach students at both the undergraduate and graduate levels. These experiences have been extremely rewarding and satisfying as I realise the student/teacher relationship is essential to the development of future research and researchers. I look forward to being a part of this great process. I believe that providing engineering students with an intuitive understanding of both theoretical and experimental concepts is an important component of teaching. Bringing forth concepts from their simplest precepts enables students to relate to the subject and develop an intuitive relationship to that which is taught. Only after a concept is understood at an elementary level, can there be a progression to a more complex and general theory. Simple models and concepts are extremely useful even at the highly advanced research level. I understand that examples play an important role in taking concepts and making them realistic and relatable to the student. It is also important to incorporate lab experiments into the classroom environment, thus allowing students to observe the applicability of the concepts taught therein.

Undergraduate and Post-graduate:

I have taught in February 2012 FATIGUE and CREEP to the StM3A. I have integrated the teaching with small experiments (a small test rig was made ad-hoc), which helped the dissemination and comprehension of the subject. I am willing to teach, for example, vibrations, propulsion or any mechanical engineering subject in need of support.

Since my PhD studies, I have collaborated with the University of Ancona (IT) and hosted MEng students involved in the ERASMUS and CAMPUS WORLD exchange programmes. I have supervised 13 students; a full list is available in APPENDIX-2. My approach is to encourage the development of both theoretical and practical aspects of research. Hence, I design small research projects which include both theoretical and experimental work. A typical project plan presents (i) literature survey, (ii) design and manufacturing of test structure and rig, (iii) response predictions (iv) measurements and (v) correlation of data. I like to assess students every two/three weeks by a short oral presentation and give them the freedom to contact me for any extra support. I consider myself successful in this approach and most of students have contributed with their works to scientific publications, both conference proceedings and journal papers.

I am also involved in supporting final year projects of MSc students in Integrated Aerospace Systems Design (IASD) at Bristol University. I have supervised one MEng student in 2011.

Graduate trainee scheme:

Since my appointment at Bristol University, I have started the supervision of graduate trainees from Rolls-Royce (see APPENDIX-3), who spend three months period in the Model Validation Facility (supported by Rolls-Royce). Their research foci and deliverables are determined together with the company needs. However, all projects are designed so as to fit the academic environment.

RESEARCH INTERESTS

I have decided to focus the first part of my academic career in developing an expertise in the area of experimental structural dynamics. This decision was supported by several difficulties in performing experimental model validation, caused by the increasing complexity of models. In fact, rapidly growing computational power has helped the development of better models which are often difficult to be validated by standard testing technologies. Hence, I started

working in this research area and focussed on experimental vibrations, measurement technologies, mechanical testing and modal analysis. I have also developed my expertise in designing mechanical test rigs and software platforms for performing experiments.

My interest in experimental work culminated with a successful achievement, and completed since my appointment at the University of Bristol. That has been the setting up of a new laboratory, now called the "**Model Validation Facility (MVF)**", as part of the BLADE laboratory. The laboratory is one of the most advanced in the country for high performance testing, also thanks to its exceptional equipments (for example with one Scanning LDV system, one large dynamic shaker and a unique contactless pulsed air-jet excitation system). This target was also obtained thanks to the support of Rolls-Royce and University of Bristol staff which had confidence and believed in my ideas.

I have worked in the area of rotorcraft dynamics where I developed measurement and excitation technologies for both stationary and rotating conditions. I designed and developed a rotating test rig and tracking techniques for measuring vibration patterns of rotating bladed discs using an innovative measurement method called Continuous Scanning LDV (CSLDV). I also designed a novel contactless exciter capable of exciting rotating structures. I have studied bladed disc dynamics using two different contactless measurement methods, such as Blade Tip Timing and SLDV system.

Important works are produced and published in the area of measurement methods using remote sensors such as Scanning Laser Doppler Vibrometer (SLDV. The novelty of this research work is to have developed an advanced modal testing which is based on a continuous scan measurement method rather than a stepped type. An important output is the design of a software platform, **CAISER MYMESIS**, performing CSLDV measurement methods (developed under contract from United States Air Force). Recently, I have been developing in collaboration with other colleagues an innovative scanning laser head (6DOF). This novel design can allow the measurement of up to six degrees of freedom at the point of measurement and therefore the potential of this new measurement technique can be beneficial to numerous engineering and bio-engineering applications.

Since 2008 I started working and publishing in the area of dynamics of composites; this activity was supported through the Rolls-Royce C-UTC. My initial work was produced in the area of model validation of composite components. My expertise in vibrations and dynamics was then focussed on development of experimental techniques for studying failure criteria of composites during High Cycle Fatigue (HCF). Some major activities and outputs in this area are briefly listed below:

- Study and development of experimental methods for performing HCF on composites. The output was the design (and development to Technology Readiness Level (TRL) 4 for Rolls-Royce) of a software platform, **MONTEVERDI**, for High Cycle Fatigue (HCF) testing using remote sensors.
- Study, design and development of a high performance contact-less excitation system. This work was supported from Rolls-Royce in MVF and the main output was the setting up of an advanced experimental capability for testing composites.
- Study of mechanical impedance between test rig and dynamic shaker used to perform HCF of composites.

Since 2011, I am involved in a research programme studying the non-linear dynamics of joints with focus on large assemblies such as engine aircraft casings. This work is supported by Rolls-Royce through the SILOET 2.3.2 research programme. A relevant expertise is being developed in the area of non linear modal testing. Additional interest has been devoted to studying dynamic non-linearities of composite and failure mechanisms under high cycle fatigue, thanks to my involvement in the R-R C-UTC.

Recently, I started working in collaboration with colleagues from Bristol University and Virginia Tech. on dynamics of lightweight structures, such as ultrathin membranes. This year I have setup a project on this topic for an MEng Erasmus student, who has used my newly developed 6DOF scanning laser head for measuring in-plane vibrations of a thin membrane. I am also starting to establish contacts with the research group of D. Robert in the Biology Department, which is focussed on studies of membranes.

I am collaborating with Prof F. Scarpa in the area of modal testing and analysis of lightweight components. We have been co-supervising 2 MEng Erasmus students in the area of nano-composites mechanical characterization and modal analysis of ultra-lightweight composite components using electromagnetic levitation.

I have been collaborating with Prof D. J. Ewins and the AgustaWestland UTC since 2009. My expertise in laser vibrometry is a useful resource for helping the AW research group. I could demonstrate the potential of using SLDV system for vibration measurements of helicopters. I setup a MEng project in collaboration with Universitá Politecnica delle Marche and AW on a research work focussed on vibrations of a scaled 5 bladed disc rotor.

I am also interest in the damage detection using non contact sensor.

Biography

Dr Dario di Maio graduated in Mechanical Engineering at Universita' Politecnica di Ancona. His final year thesis was produced at Imperial College London with a work supported by BOSCH (August 2000- April 2001). The thesis was focused on measurements of brake disc squeal using Scanning Laser Doppler Vibrometry (SLDV) system.

Dr di Maio was awarded a PhD in Mechanical Engineering from Imperial College London with a project supported by US Air Force. The PhD thesis was focused on the development of tracking measurements of rotating bladed disc using Continuous Scanning LDV methods. One output of the thesis was the development and production of a software platform called CAISER MYMESIS capable of performing Continuous Scanning LDV measurement methods on structures under stationary and rotating conditions.

Subsequent activities include a post-Doctoral position in Imperial College (2007) during which Dr di Maio managed a project supported by Rolls Royce on vibration measurements of rotating bladed discs using both Blade Tip Timing (BTT) system and tracking Scanning LDV system.

Subsequently (2008) he has held a post-Doctoral position in the Rolls Royce Composite University Technology Centre (UTC) at University of Bristol developing and applying advanced experimental methods for vibration testing of components and other gas turbine structures. A significant achievement is the building of a new laboratory, now called the "Model Validation Facility (MVF)", as part of the BLADE laboratory.

During his PhD and Post-Doc Dr di Maio designed and supervised several short projects on experimental measurements for both international students and R-R graduate trainees.

Memberships

Organisations

Department of Mechanical Engineering

Research Groups

- Bristol Composites Institute

Recent publications

- Chi, X, Di Maio, D & Lieven, N, 2019, 'Modal-based vibrothermography using feature extraction with application to composite materials'. *STRUCTURAL HEALTH MONITORING*.
- Liu, Y, MacDonald, J & Di Maio, D, 2019, 'Modal parameter identification from measurements of vehicle-bridge interaction'. in: Shamim Pakzad (eds) *Dynamics of Civil Structures, Volume 2 - Proceedings of the 36th IMAC, A Conference and Exposition on Structural Dynamics 2018*. Springer New York LLC, pp. 247-249
- Di Maio, D, Magi, F & Sever, IA, 2018, 'Damage Monitoring of Composite Components under Vibration Fatigue using Scanning Laser Doppler Vibrometer'. *Experimental Mechanics*.
- Cooper, S & Di Maio, D, 2018, 'Static load estimation using artificial neural network: Application on a wing rib'. *Advances in Engineering Software*.
- Chi, X, Di Maio, D & Lieven, N, 2018, 'Dynamic response and energy loss in jointed structures using finite element methods: application to an aero-engine casing assembly'. in: Wim Desmet, Bert Pluymers, David Moens, Ward Rottiers (eds) *Proceedings of International Conference on Noise and Vibration Engineering, ISMA2018 and International Conference on Uncertainty in Structural Dynamics, USD2018: Organised in conjunction with the 7th edition of the International Conference on Uncertainty in Structural Dynamics - USD2018*. KU Leuven - Departement Werktuigkunde, Leuven, Belgium, pp. 1835-1849
- Giovannelli, A, Di Maio, D & Scarpa, F, 2017, 'Industrial-graded epoxy nanocomposites with mechanically dispersed multi-walled carbon nanotubes: Static and damping properties'. *Materials*, vol 10.
- Di Maio, D, Mitha, Z, Paul, JV & Chi, X, 2017, 'Variability of Dynamic Response in Jointed Structures'. in: Matthew S Allen, Randall L Mayes, Daniel Jean Rixen (eds) *Dynamics of Coupled Structures, Volume 4: Proceedings of the 35th IMAC, A Conference and Exposition on Structural Dynamics 2017*. Springer, pp. 331-347
- Magi, F, Di Maio, D & Sever, I, 2017, 'Validation of initial crack propagation under vibration fatigue by Finite Element analysis'. *International Journal of Fatigue*, vol 104., pp. 183-194
- Liu, Y, Macdonald, J & Di Maio, D, 2017, 'Identification of modal parameters based on moving load excitation'. *Procedia Engineering*, vol 199., pp. 960-965
- Carri, Ad, Weekes, B, Di Maio, D & Ewins, D, 2017, 'Extending modal testing technology for model validation of engineering structures with sparse nonlinearities: A first case study'. *Mechanical Systems and Signal Processing*, vol 84 Part B., pp. 97-115

View complete publications list in the University of Bristol publications system