Australasian research on Applied Mechanics and Aerospace - Preface

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Special Issue on Australasian research on Applied Mechanics and Aerospace

For the aerospace industry, Australasian regions have great potential. Nowadays, nearly three billion passengers a year are travelling on commercial airlines, and this number continues to grow, especially in *Australasia*. In this region, demand for new aircraft is therefore rising. The major aircraft companies, for example, estimated that *one-third of the entire manufactured aircraft* will be delivered to Asia in the next two decades. Thus, it is not a surprise that the common opinion wants Australasia to become the centre of the world for aerospace manufacturing and engineering knowledge development in the near future.

The present issue of *Advances in Aircraft and Spacecraft Science* (AAS) intends to publish some *selected, extended and peer-reviewed* papers that were presented at the *8th Australasian Congress on Applied Mechanics* (ACAM) from 23 to 26 November 2014. In particular, the present issue collects those ACAM works that were mainly devoted to disciplines related to aircraft, spacecraft and rotorcraft, in line with the aims of AAS International Journal. In the first of these contributions, Filippi and Carrera (2015) extended the one-dimensional Carrera Unified Formulation (CUF) to free-vibration analysis of metallic and composite rotating structures. By employing CUF, which is a hierarchical formulation that enables one to write the governing equations in terms of fundamental nuclei, the authors were able to devise solutions for arbitrary-order beam models of rotors and shafts including both gyroscopic and stiffening contributions. In fact, the CUF fundamental nuclei are invariant with the theory order and Finite Element (FE) approximation. Jayatilake *et al.* (2015) present a research about stiffness reduction of delaminated composite structures. In this work, the authors developed a 3D FE model and investigated the free vibration behaviour of fibre composite multilayer sandwich panels with interlayer delaminations. By using a commercially available FE code, a series of parametric studies were conducted and simulations about bolting as a remedial measure to fasten the delamination region were carried out. In another contribution of this special issue, Kalyanasundaram and Venkatesan (2015) investigated the feasibility of using the stamp forming technique for the processing of thermoplastic, recyclable composite materials. In their research, the authors used a self-reinforced polypropylene composite material (Curv®). A detailed experimental study was conducted and a Design of Experiments (DOE) methodology was adopted to elucidate the effect of process parameters that included blank holder force, pre heat temperature and feed rate on stamp forming. Mochida and Ilanko (2015) discuss a work about condensation method and Rayleigh-Ritz minimisation for the free vibration analysis of axially loaded, slightly curved beams subjected to partial axial restrains. The methodology proposed was applied to simply supported and partially clamped beams with three different shapes of imperfection. In their paper, Nam *et al.* (2015) present findings on strain evolutions at different points along and at 45º to fibre directions of circular Fibre Metal Laminate (FML) blank, through various stages of forming. FML based on steel and self-reinforced polypropylene was stamp-formed into dome shapes under different blank holder forces. Moreover, an open-die configuration was used in a hydraulic press so that a 3D photogrammetric measurement system (ARAMIS) could capture real-time surface strains. In a previous volume of AAS, Pagani *et al.* (2014) already published some of the results that were discussed

by the authors at ACAM8. In that work, they proposed exact, refined, CUF-based 1D dynamic stiffness elements for the flutter analysis of plate-like metallic and composite wing structures. In the present special issue, the same authors (Pagani and Carrera 2015) discuss a 0D mathematical formulation for rapid and explosive decompression analyses of pressurized aircraft with active venting (both swinging and translational blowout panels are addressed). The formulation is based on the assumption of isentropic flow and models both subcritical and supercritical decompression phases. In the final paper of the present issue, Petrolo *et al.* (2015) write about free vibration analysis of damaged beam structures. In this work, the attention is focussed on a particular class of the 1D-CUF models, which is based in the Lagrange approximation of the primarily variables on the cross-section. The research demonstrates that the proposed methodology is able to mimic correctly the behaviour of structures subjected to both global and local damages with a substantial reduction of the computational costs with respect to 2D and 3D models.

The guest editors wish the present issue to be of interest for AAS readership and people working in the field of aircraft and spacecraft science. We would also take the opportunity to thank the authors for their valuable manuscripts, and the reviewers for their efforts in providing us with useful comments. Also, we would like to thank AAS Editor-in-Chief, Professor Erasmo Carrera, for his support and for giving us the opportunity to select and handle the manuscripts of the present special issue.

References

Filippi, M. and Carrera, E. (2016), "Capabilities of 1D CUF-based models to analyse metallic/composite rotors", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 1-14.

Jayatilake, I.N., Karunasena, W. and Lokuge, W. (2016), "Finite element based dynamic analysis of multilayer fibre composite sandwich plates with interlayer delaminations", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 15-28.

Kalyanasundaram, A. and Venkatesan, S. (2016), "Effect of temperature and blank holder force on non-isothermal stamp forming of a self-reinforced composite", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 29-43.

Mochida, Y. and Ilanko, S. (2016), "Condensation of independent variables in free vibration analysis of curved beams", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 45-59.

Nam, J., Cantwell, W., Das, R., Lowe, A. and Kalyanasundaram, A. (2016), "Deformation behaviour of steel/SRPP fibre metal laminate characterised by evolution of surface strains", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 61-75.

Pagani, A., Petrolo, M. and Carrera, E. (2014), "Flutter analysis by refined 1D dynamic stiffness elements and doublet lattice method", *Adv. Aircraft Spacecraft Sci.*, **1**(3), 291-310.

Pagani, A. and Carrera, E. (2016), "Gasdynamics of rapid and explosive decompressions of pressurized aircraft including active venting", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 77-93.

Petrolo, M., Carrera, E. and Alawami, A.S.A.S. (2016), "Free vibration analysis of damaged beams via refined models", *Adv. Aircraft Spacecraft Sci.*, **3**(1), 95-112.

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