

Preface

Special Issue on Composite and Smart Materials for Aircraft and Spacecraft Structures

Spacecraft and aircraft industries were the first stimuli in the seventies of the last century, and main drivers, since the beginning of this century, of developing and using advanced materials which principal representatives are *composite* and *smart* ones. *Composite materials* are currently not only used in components but also in load-carrying structural elements, like in latest aircraft and spacecraft fuselages and wings. They are known to have nice advantages but also severe disadvantages that necessitate their periodic, and even continuous for hot spots, monitoring for maintenance and control using *sensors*, *actuators* and *transducers*. This requires integrating *smart materials* which popular representative is *piezoelectric* ones, so that this combination with composites increases their functionality in the sense that high added value applications can be tackled such as structural shape *morphing*, vibration *damping*, noise control, health monitoring and prognosis. Hence, mastering *composite and smart materials* behaviour, design and response predictions is crucial for continuing their successful use in spacecraft and aircraft industries and widening it to others (automotive, railway, mechanical, civil, etc...); this can include full properties *characterization*, developing specific *design tools*, and understanding manufacturing or assembly process simulations and structure – transducers *interactions*.

Therefore, the present issue of *Advances in Aircraft and Spacecraft Science* (AAS) international journal is focused on this critical topic for aircraft and spacecraft industries. It contains initially eight *extended* and *peer-reviewed* manuscripts from twelve submitted ones. Half of accepted contributions (Boehle *et al.* 2015, Bordeu *et al.* 2015, Cherouat and Bourouchaki 2015, Munoz *et al.* 2015) were presented at the 5th *International Symposium on “Air/Craft MAterials-ACMA”* held at Marrakech (Morocco) from 23 to 26 April 2014, including a mini-symposium on one of its major topics of ‘*composite and smart materials*’ that was organized by present guest editor. One of these four contributions concerned an *advanced numerical tool for composite woven fabric preforming* and has appeared in an earlier AAS issue (Cherouat and Bourouchaki 2015), while the other three contributions address these topics: (i) a new methodology for *complex frame aircraft structures optimization and analysis* using Proper Generalized Decomposition (PGD) model reduction technique (Bordeu *et al.* 2015), (ii) *identification of full elastic properties* of Carbon Fiber Reinforced Polymer (CFRP) composites using full fields imaging and ultrasonic immersion techniques (Munoz *et al.* 2015), (iii) strain response prediction of a *composite with an embedded fuzzy fibre sensor* composed of a bundle of fibre glass fibres coated with Carbon Nano Tubes (CNT) through a thermal chemical vapour deposition process (Boehle *et al.* 2015). The other four contributions (Benjeddou 2015, Botha *et al.* 2015, Dwarakanathan *et al.* 2015, Pontecorvo *et al.* 2015) were invited but subjected to the journal regular peer-review process. They address these topics: (iv) numerical assessment of approximate and simplified analyses of *shear-mode piezoelectric modal effective electromechanical coupling* (Benjeddou 2015) for use in energy *transduction* within vibration shunted *damping* or harvesting applications, (v) development and demonstration of a *trailing edge*

wing surface morphing concept using macro-fibre composite (MFC) piezoelectric actuators (Dwarakanathan *et al.* 2015), (vi) optimisation of a *novel trailing edge concept* (referred to as the flap extension) for a high lift device in order to increase aerodynamic performance and decrease aerodynamically generated noise of aircraft profiles in a high lift configuration, (vii) design, fabrication, testing and analysis of a *novel load-bearing element with energy dissipation capability* (Pontecorvo *et al.* 2015) that could be used in helicopter, aircraft or spacecraft applications.

As a guest editor, I hope sincerely that this topical issue contributes significantly to the state-of-the-art of this aircraft and spacecraft research and engineering interest area of *composite and smart materials* so that it can serve the needs of AAS academia and industry readers and contributors. I would like also to take this opportunity to thank, *authors* for their good contributions, *reviewers* for their help in assessing submitted contributions, *Editor-in-Chief* of AAS (Professor Erasmo Carrera) for letting me the responsibility to select this issue contributions, nominate reviewers and manage 10 of the 12 submissions, and for his managing of my contribution (for intellectual integrity reason) and that of Botha *et al.* (submitted online), and *Assistant Editor* of AAS (Alfonso Pagani) for his prompt reactions and motivated answers to my numerous emails.

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Guest Editor
Professor Ayech Benjeddou
benjeddou@supmeca.fr
Institut Supérieur de Mécanique de Paris
France