

# Special issue on Piezoelectric Integrated Composite Smart Structures

## Preface

*Composites* are nowadays widely used as structural materials in particular for transport (Aerospace, Aeronautic, Automotive, Railway, and Ship) vehicles and infrastructures (Civil, Mechanical). Due to their sensitivities to damage, vibration and, in order to enhance their performance, advanced structural composites need to integrate new functionalities, such as sensing, actuation, vibration damping, noise reduction, shape control, morphing, health monitoring, etc. The latter can be implemented using *piezoelectric* transducers, control algorithms and processing devices, providing *smartness* to these integrated composite structures. Piezoelectric transducers are currently used as monolithic piezoceramics, without (ex. PZT) or with soft encapsulation (ex. DuraAct<sup>®</sup>), as micro (ex. AFC) or macro (ex. MFC) piezoceramic fibre reinforced composites, and as piezoelectric polymers (PVDF), without or with inter-digitated electrodes (IDE). To reach robust *designs* of the resulting integrated composite smart structures, intense research efforts are currently conducted in order to make available: (i) complete and reliable electromechanical materials *properties*; (ii) experimental *benchmarks* for effective behaviours and, static/dynamic responses *characterizations*; (iii) efficient coupled multi-physical *modelling* and simulation tools.

To reach above goals, this focused issue of *Smart Structures and Systems* (SSS) presents *five* revised, among eight peer-reviewed, manuscripts, of which one was an extension from that presented at the Symposium G on “*Embodying Intelligence in Structures and Integrated Systems*” (which programme chair was Professor Fabio Casciati, Regional Editor of SSS) that held during the CIMTEC 4<sup>th</sup> *International conference on smart materials, structures and systems*, 10-14 June 2012, Montecatini Terme (Italy), and two others were extensions from those presented at the 5<sup>th</sup> *European Conference on Structural Control*, 18-20 June 2012, Genoa (Italy). These five contributions focused on one or more of above mentioned multidisciplinary aspects of *piezoelectric integrated composite smart structures*; in particular, numerical and mixed numerical–experimental *characterizations* of non-integrated  $d_{31}$  AFC/ $d_{15}$  MFC and integrated PZT PIC255 transducers, experimental *benchmarking* for the piezoelectric  $d_{15}$  shear-induced torsion actuation mechanism, design, *modelling* and experimentation of passive (shunted) and active (DuraAct<sup>®</sup>) modal control of plates, and active (PZT) shape control of beams. It is hoped that this focused issue advances the state-of-the-art and serves the needs of the SSS community of researchers, engineers and practitioners.

As a closure, I would like to thank the authors, for their valuable contributions, the reviewers, for their careful expertises, and Professor Fabio Casciati, the regional Editor-in-Chief for Europe of SSS, for letting me the entire freedom of this issue management and for his great help in managing anonymously my co-authored contributions.

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