Editorial

Volnei Tita*

Aeronautical Engineering Department,
São Carlos School of Engineering,
University of São Paulo,
Av. João Dagnone n.1100, 13.573-000,
São Carlos, São Paulo, Brazil
Email: voltita@sc.usp.br
*Corresponding author

Rui Miranda Guedes

Mechanical Engineering Department,
Faculty of Engineering of University of Porto,
Rua Dr Roberto Frias s/n, 4200-465, Porto, Portugal
Email: rmguedes@fe.up.pt

Biographical notes: Volnei Tita graduated in Mechanical Engineering in 1996 from University of São Paulo (USP – Brazil) and, also, he obtained his Master in 1999 and PhD in 2003 from USP. He developed a post doctorate at USP (Brazil – 2004) and at Katholieke Universiteit Leuven (Belgium – 2012). He is an Associate Professor in the Aeronautic Engineering Department at USP since 2011. He has published more than 100 papers in scientific journals and proceedings of conferences. He is reviewer of 15 journals and Editorial board member of three journals. He was a Secretary of the Aerospace Scientific Committee of Mechanical Science Brazilian Association.

Rui M. Guedes research focuses on polymer-based composite materials. His main interest is in durability and long-time prediction of mechanical behaviour of composite structures. More recently has been working in biodegradable medical devices for ligament repair. He received his MSc in Structural Engineering in 1992 and PhD in Mechanical Engineering from the University of Porto in 1997. In 1997, he joined the Mechanical Engineering Department of the University of Porto. He received his Habilition in Mechanical Engineering from the University of Porto in 2012. He has published more than 45 papers in scientific journals, six book chapters and edited one book.

Recent improvements in manufacturing processes and materials properties associated to excellent mechanical characteristics and low density have made advanced composite materials (ACM) very attractive for application on automotive structures. However, even new designs are still very conservative, because the behaviour of ACM is very complex. In fact, modelling of composite structures is very complicated, e.g., these structures exhibit multiple types of damage before total rupture associated to viscoelastic or viscoplastic behaviour.

For supporting the design of automotive parts made of ACM from concepts to engineering details, it is required to use consistent material models. Based on the

observation of the major physic mechanisms, it is possible to develop a mathematical formulation to model the behaviour of composite structures. Moreover, by using experiments and/or literature data, it is possible to identify the parameters related to the proposed material model. The feasibility of implementing the material model as a computational tool depends on the complexity of its mathematical formulation. In order to check its potentialities and limitations the material model proposal must be evaluated against experimental data and/or other models.

Hence, the material model usually needs to be investigated for quasi-static and/or impact loadings, for fatigue and/or durability, for vibration and/or environmental effects, considering the requirements imposed by the design.

Different approaches and material models have been developed to simulate the structures behaviour made of ACM. Although the number of approaches and models has increased immensely, the prediction of the composite structures behaviour is still a big challenge. By one side, due to the intrinsic heterogeneity and/or anisotropy of composite materials the predictions become very complex and not well defined. However, by other side, these characteristics give the opportunity to design not only the structure, but also the material. Thus, sometimes, it is strategic to use multi-scale approaches. Therefore, it is a really hard task to achieve the requirements imposed by the automotive standards, while the engineers search to obtain the best performance of the ACM part, i.e., to achieve the optimum design.

Therefore, this special issue aims to enhance the link between different fields of expertise that includes the numerical tools to predict the mechanical behaviour of ACM including material models for ACM, as well as material design and structural analysis of automotive components made from these types of materials. Hopefully, this will bring new insights and developments on mathematical formulation of new material models, on aspects related to parameters identification and computational implementation and analyses, as well as on validation process by using experiments, literature data and/or other models. This special issue publishes articles of interest to structure and material researchers, to engineers and to other scientists involved with modelling of ACM, mainly related to automotive applications.

Finally, the guest editors are grateful to all authors for their effort in writing the papers in time and acknowledge the outstanding work of all reviewers, allowing this special issue to be published as planned. The authors would like to thank Professor Ahmed Elmarakbi, from Sunderland's Department of Computing, Engineering and Technology and the Inderscience Publishers for the opportunity to produce this Special Issue, as well.