Virtual testing framework for accelerated development of composite structures for impact applications: Experiments and simulations

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Composite materials are widely used for aeronautical applications due to their specific stiffness and strength, however, they present a very brittle response against impact [1]. The development of numerical models that can accurately predict the physics involved during the impact event is critical to accelerate the design of composite structures. The present research is focused on the development of a validated numerical framework able to capture the non-linear response and strain rate dependency of the composite to predict the final energy absorption capacity. Special emphasis has been given to the experimental and numerical characterisation of composites subjected to high strain rates, including the technical challenges of the dynamic experimental techniques, the complex micromechanical response and the implementation of constitutive laws to predict the catastrophic failure of structural components against impact. Finally, the implementation of this approach for aerospace applications will be explored, including quasi-static, dynamics and low velocity impact testing [2].

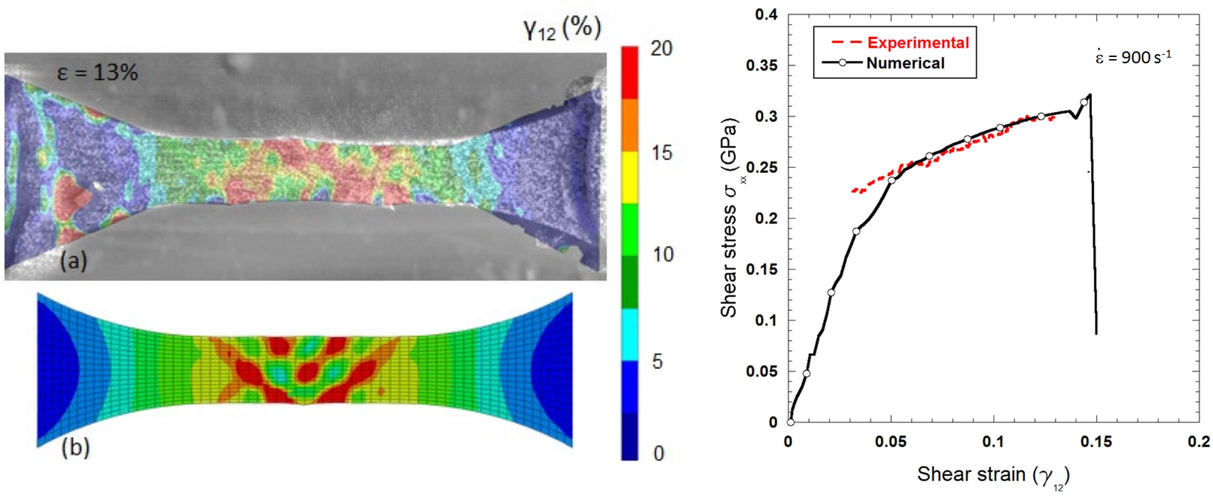

Fig. 1 (a) Experimental engineering shear strain for 13% applied deformation for a 8HS S2/Epoxy composite at quasi-static and high strain rate (900 s^{-1}) and (b) numerical correlation. (c) Correlation between the representative shear engineering stress *vs* engineering strain curves.

References

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[2] Martinez Hergueta, F., Ares, D., Petrinic, N., Comp. Struct., 210, (2019) 840–857.