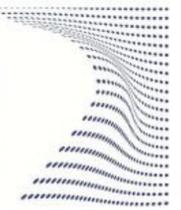


Residual mechanical properties evaluation and design of composite structures under crash impacts



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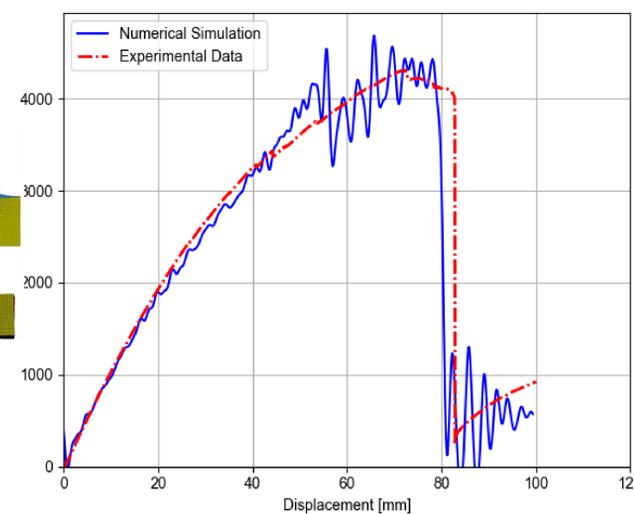
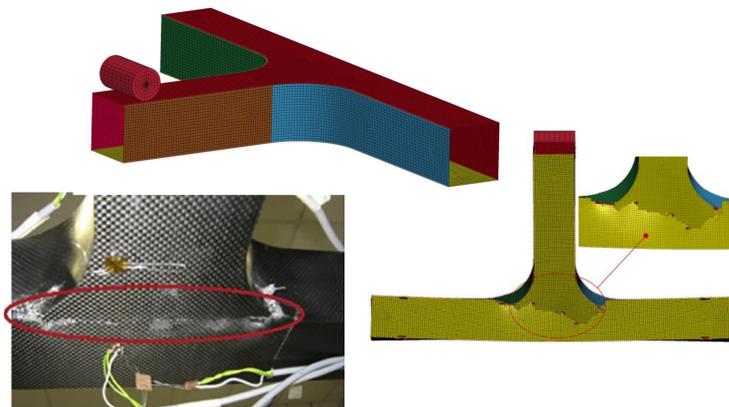
Motivation

- Reduction of CO2 emissions and fuel consumption in transport vehicles by reducing weight of structures.
- Use of composite materials as replacement of standard metals among the most effective solutions.
- Characterization of damage evolution and evaluation in composite materials currently among the most important challenges for complete spread worldwide.

What has been done

T-joint composite structure:

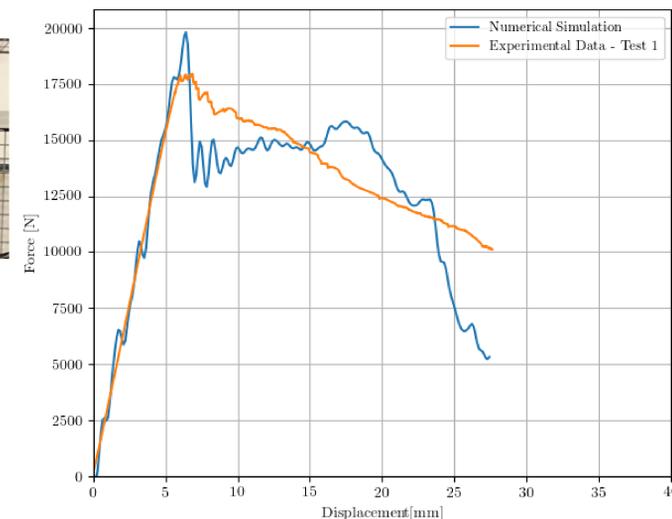
- Structural analysis of a T-joint composite material structure
- Correlation between experimental and numerical results
- Excellent agreement in failure mode



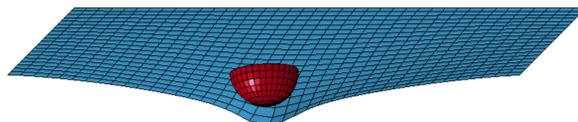
Composite plate:

- Damaging of composite plates with different loads (4 points bending, low energy impacts)
- Numerical model of experimental tests in LS-DYNA
- Correlation between numerical and experimental results

4 points bending test:



low energy impacts:



What is next

- Experimental evaluation of residual mechanical properties (elastic moduli)
- Correlation of experimental and numerical results for different load cases
- Comparison of numerical and experimental results when residual mechanical properties are considered

Research Plan

1. Development of a numerical-analytical model for evaluation of residual properties of damaged composite structures.
2. Experimental validation
3. Correlation between residual properties previously evaluated and energy absorption capacity of (damaged) structures

Publications

Boursier Niutta C., Wehrle E.J., Duddeck F. and Belingardi G. "Surrogate modeling in the design optimization of structures with discontinuous responses: a new approach for ill-posed problems in crashworthiness design", *Structural and Multidisciplinary Optimization*, 57(5):1857-1869, 2018.

Boursier Niutta C., Ciardiello R., Belingardi G. and Scattina A. "Experimental and numerical analysis of a pristine and a nano-modified thermoplastic adhesive", in *Proceedings of PVP2018, Prague*, 2018.

Boursier Niutta C., Koricho E.G. and Belingardi G. "Improvements in the structural analysis of a composite material T-joint structure", in *Proceedings of the 33rd ASC - 18th US-Japan Conference on Composite Materials, Seattle*, 2018.