

Presentazione Ammissione all'anno successivo

35° Ciclo di Dottorato



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TUTORE

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TEMATICA

SAFETY, LIGHTWEIGHT AND
ECOLOGY IN VEHICLE DESIGN



BORSA

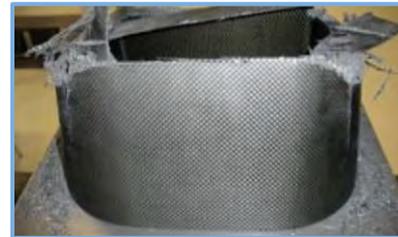
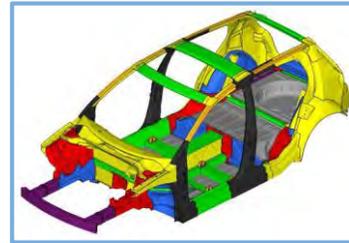
ATENEEO

NEED FOR DIFFERENT MATERIALS

100 KG WEIGHT REDUCTION LEAD TO A FUEL RECOVERY OF 0,35L/100KM, AND 8,4G CO₂/KM.

Research Activities

- State of the Art
- Research Goal
- Crashworthiness
- Biomechanics
- Future Developments



Goede et al, 2009

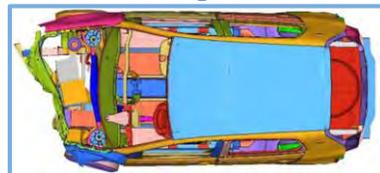
Obradovic et al, 2012

Striwe et al, 2018

Material Replacement with
alluminum and Passive
Safety Evaluation

Impact Response of
thermosetting composite
components for automotive
application

Thermoplastic Composite
Materials for Automotive
Application



WHAT'S
NEXT?

WHICH IS OUR GOAL?

Research Activities

- State of the Art
- Research Goal
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LIGHTWEIGHT



ECOLOGY



SAFETY

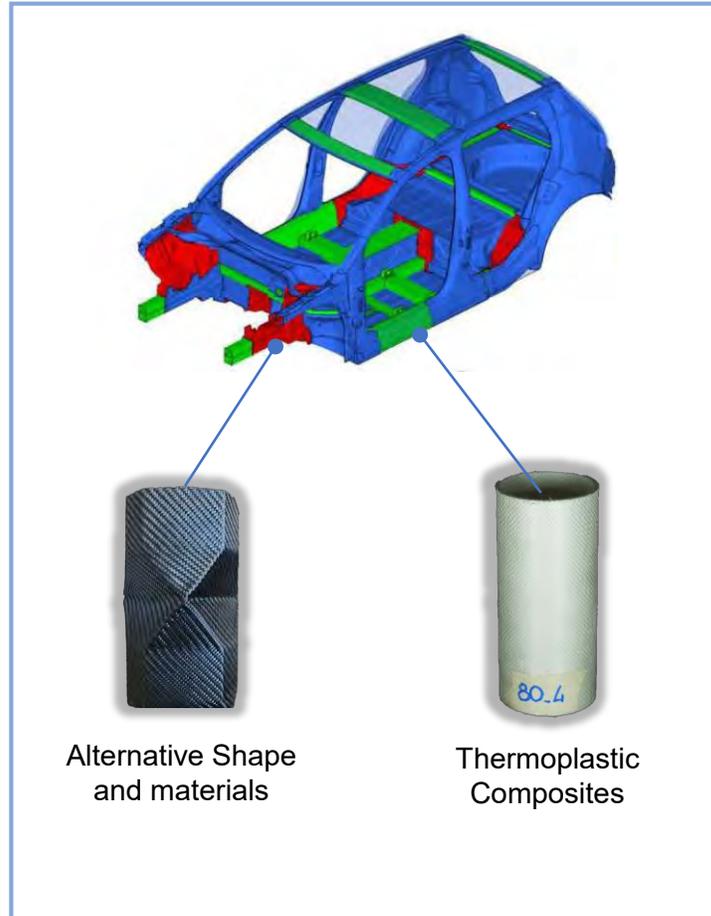


WHICH IS OUR APPROACH?

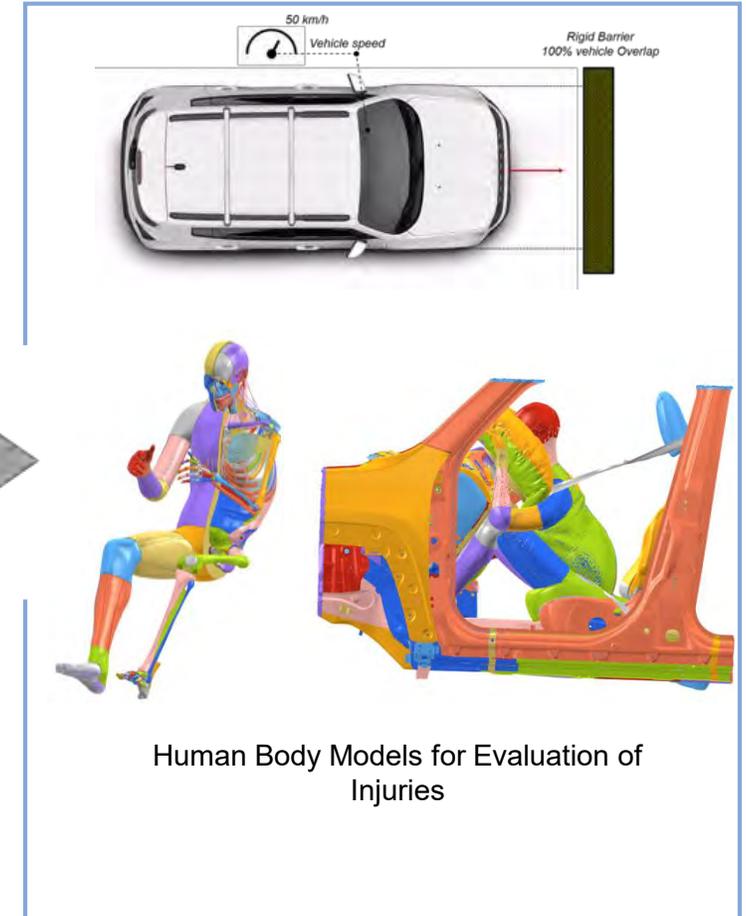
Research Activities

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MULTI-MATERIAL DESIGN FOR METAL REPLACEMENT



PASSIVE SAFETY ASSESSMENT WITH HBMS



CRASHWORTHINESS STUDY

Research Activities

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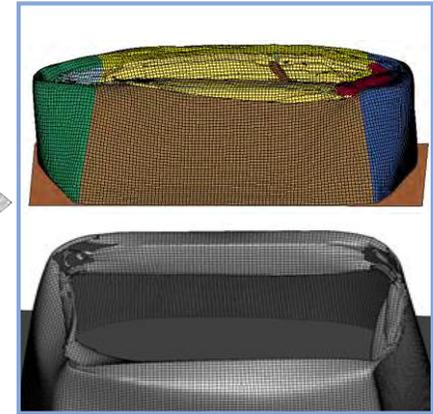
Material Characterization



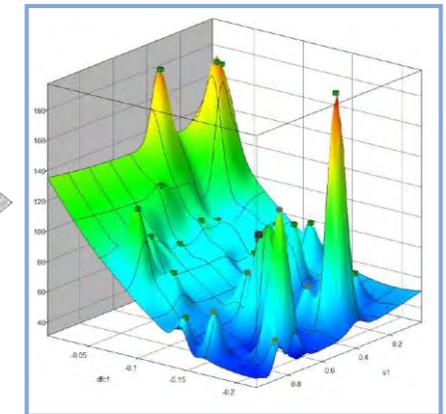
Test on Component



Numerical Correlation



Parameter Optimization



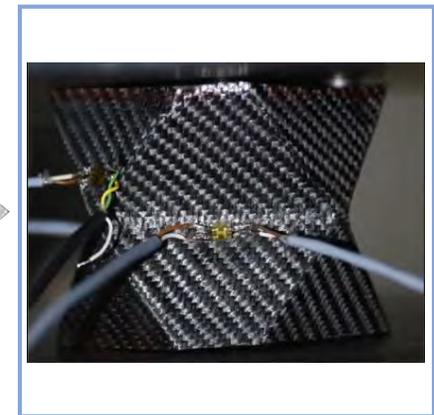
↑ MATERIAL PARAMETER IDENTIFICATION OF A THERMOPLASTIC VEHICLE COMPONENT [1][2][3][4]

↓ EXPERIMENTAL STUDY AND SHAPE OPTIMIZATION OF AN ORIGAMI CRASH-BOX [5]

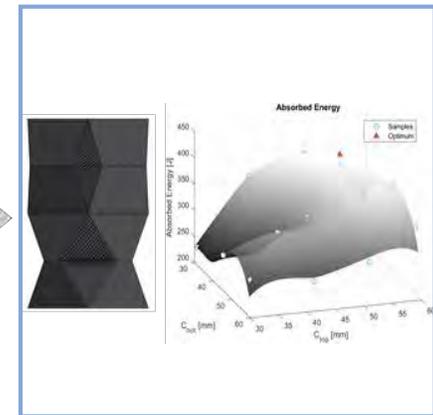
Prototype Manufacturing



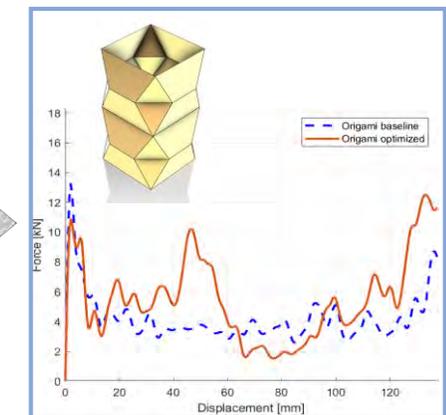
Prototype Quasi-Static test



FE Correlation & Shape Optimization



Results & Optimal Shape





BIOMECHANICS

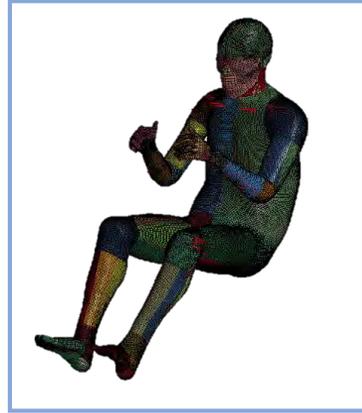
PROJECT IN COLLABORATION WITH



Research Activities

- State of the Art
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Human Body Model



Positioning Strategies



Mesh Degradation



Results

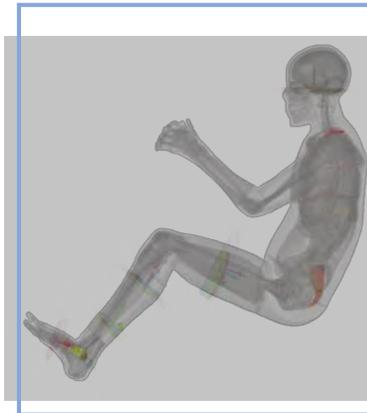


MODEL MANAGEMENT & POSITIONING STRATEGIES [6]



INJURY EVALUATION THROUGH DIRECT METRICS [7]

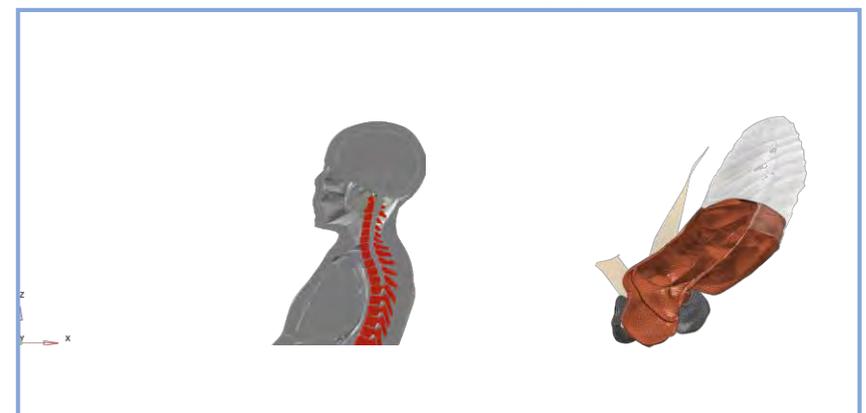
Sensing Strategies



Impact Simulation



Direct and Indirect Metrics for Injury Evaluation



WHAT COMES NEXT?

SAFETY, LIGHTWEIGHT AND ECOLOGY IN VEHICLE DESIGN

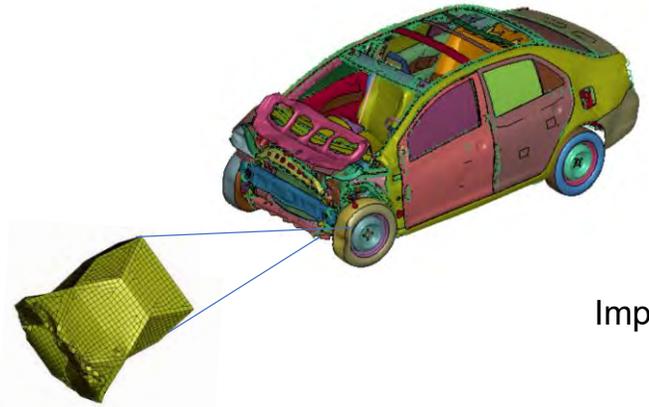
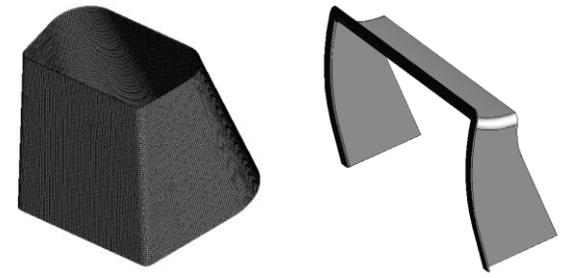
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THERMOPLASTIC

Investigate and optimize other numerical parameters to obtain an higher numerical accuracy.

Define and simulate in FE environment others vehicle's components made in thermoplastic material.



Manufacturing of the origami component with optimized shape.

Quasi-static tests and impact tests.

Correlation between experimental tests and numerical model.

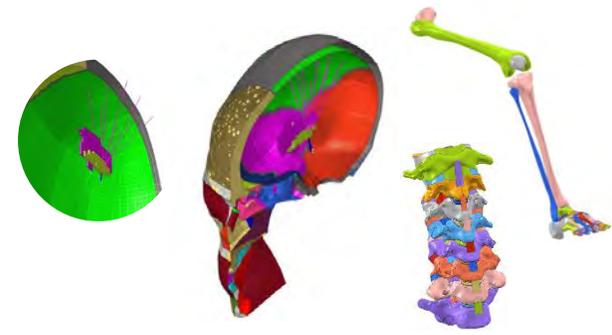
Implementation of the Origami Crash-Box in a Full Scale vehicle FE model.

ORIGAMI

BIOMECHANICS

Study of innovative injury metrics

Passive Safety Assessment after the replacement of conventional structural components.





SHORT RESUME

TEACHING ACTIVITIES

Classroom-lab practice – Design of Lightweight and Composite Structures. II Level Course. 20 Hours of lectures, 3 session of exams

SCIENTIFIC PAPERS

- [1] D. Fiumarella, S. Boria, G. Belingardi, A. Scattina. Experimental and numerical analysis of a thermoplastic lamina for composite material. *Procedia Structural Integrity*, 24 (2019), 11-27.
- [2] D. Fiumarella, S. Boria, G. Belingardi, A. Scattina. Experimental characterization and finite element modelling of a thermoplastic composite lamina subjected to large shear deformation. *Material Design & Processing Communications*, 1-7 (2020).
- [3] S. Boria, G. Belingardi, D. Fiumarella, A. Scattina. Experimental crushing analysis of thermoplastic and hybrid composites. *Composite Structures*, 226 (2019).

CONFERENCE

- [4] D. Fiumarella, E. Raponi. Experimental Analysis and Numerical Optimization of a Thermoplastic Composite in Crashworthiness. *AIAS Conference* (2020).
- [5] A. Ciampaglia, D. Fiumarella, C. Boursier Niutta, R. Ciardiello, G. Belingardi. Impact response of an Origami-Shaped Composite CrashBox. *23rd International Conference on Composite Structures & 6th International Conference on Mechanics of Composites* (2020).
- [6] D. Fiumarella, F. Germanetti, G. Belingardi, F. Cappellino, A. Scattina. Positioning Methodologies of Finite Element Human Body Models. *SimBio Conference* (2020).
- [7] F. Germanetti, D. Fiumarella, G. Belingardi, A. Scattina. Human Body Model e Sicurezza Passiva dei Veicoli a Guida Autonoma. *AIAS Conference 2020*.

COLLABORATIONS

FCA/CRF – POLITO - Human Body Models for Autonomous Driving.

University of Camerino - Analysis and Optimization of a Thermoplastic Composite in Crashworthiness

THANK YOU FOR THE
ATTENTION