ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

LIGHTWEIGHT STRUCTURES AND MATERIALS

The synergistic use of innovation in Material Science, Structural Design, and Production Technologies is a key enabler for the production of fully optimized lightweight structures.

The research of the University of Bologna covers a wide range of issues:

Damage Tolerance (DT) of metallic and composite structures

- LEAF: an analytical tool for the assessment of the DT proprieties of stiffened panels
- Fatigue crack propagation models underneath bonded stiffeners
- Delamination growth analytical and numerical models
- Experimental test of crash behavior in carbon fiber reinforced plastic (CFRP) components
- Numerical modeling of progressive damage in CFRP structures

Laser Shock Peening (LSP)

- LSP treatment of aluminum specimens to increase their fatigue life
- Residual stress measurement
- Numerical models for the prediction of residual stress profiles in LSP treated components

Additive Manufacturing (AM)

- Use of additive manufacturing technologies for rapid tooling
- Design of optimized components fabricated through Additive Manufacturing technologies

HIGHLIGHTS

Research addresses the damage tolerance properties of aeronautical structures, providing solutions for the improvement of fatigue life and the design of fully optimized structures, in order to enable the aerospace products of tomorrow to meet rising performance demands. Furthermore, the design of fully optimized structures is tightly constrained by the manufacturing processes in use. The introduction of advanced additive manufacturing technologies leads to the production of near-net complex shapes with potential savings in terms of weight.

Static and fatigue test on composite materials.

Structural Health Monitoring of aerospace structures. Fiber Bragg Grating sensing systems are used to evaluate the stress and strain field in composite and metallic structures.

Damage tolerance analysis of advanced aerospace structures. Numerical and analytical simulations of crack growth in aerospace stiffened structures are performed.