



## OO/UC3M/57- ANALYSIS AND MODELIZATION OF LIGHTWEIGHT STRUCTURES SUBJECTED TO IMPACT

*Mechanics of Advanced Materials* research group (Department of Continuum Mechanics and Structural Analysis) of the University Carlos III of Madrid (Spain) offers their experience in the analysis and modelization of high and low velocity impact behaviour of composite structures. Their research focuses on both numerical analysis and non-standard experimental methodologies).

### Description and special features

The research groups offers

- Analysis and modelization of laminated and sandwich structures subjected to high and low velocity impulsive loads
- Analysis and modelization of energy absorption structures
- Damage tolerance studies of composite structures subjected to different types of loads
- Innovation and development of non-standard experimental methodologies to test structures subjected to impact loads, with special emphasis on the evaluation of the damage tolerance
- Modelization and experimental analysis of the mechanical behaviour of composite materials in dynamic conditions

The research group has a laboratory with several test devices where it is possible to do impact and damage tolerance tests to validate the theoretical models. Among these devices there are:

- 2 Split Hopkinson bars to do tensile, compression, bending and shear dynamic tests
- 3 gas guns with maximum impact energies of 2 kJ to 20 kJ
- 1 high velocity universal testing machine of up to 20 m/s
- 2 instrumented Charpy pendulums with maximum impact energies of 50J and 300J
- 1 drop weight tower with 1000J of maximum energy  
(with a climatic chamber to do tests between  $-150^{\circ}\text{C}$  and  $200^{\circ}\text{C}$ )
- 1 pneumatic launcher of 1800J and a maximum velocity of 16 m/s
- 2 non-destructive ultrasound evaluation testing devices (1 A-scan and 1 C-scan)
- 1 high velocity camera of 250000 frames per second

The group has a computer laboratory with high performance computers to perform numerical simulation using numerical codes (ABAQUS; LS-DYNA, Autodyn, MARC).

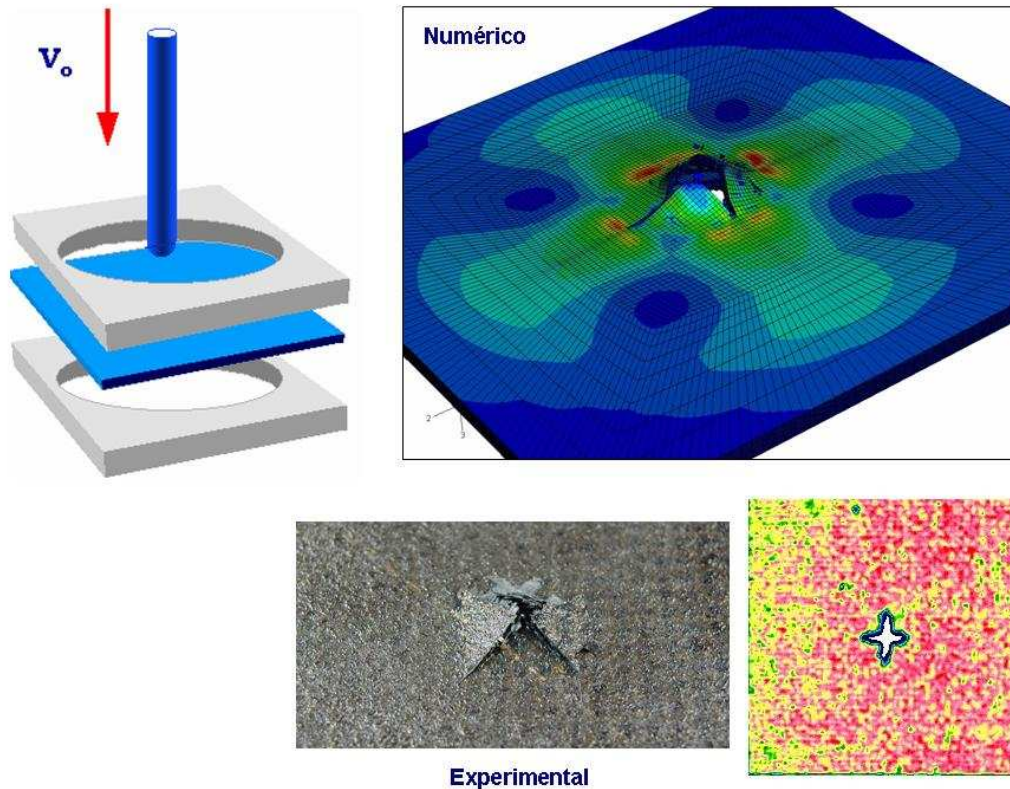


Fig. 1. Experimental and numerical analysis of composite panel subjected to low velocity impact

#### Innovative aspects

Development of specific methodologies for impact tests of thin composite structural elements , evaluating their damage tolerance when subjected to different load conditions.

Use of numerical models implemented in commercial codes to analyze the failure of composite and sandwich structural elements, considering the special characteristics of this type of materials.

#### Competitive advantages

This technology would allow a company to study composite structural elements subjected to high and low velocity impulsive loads by means of numerical models.

It has the capacities of a well-equipped experimental laboratory which permits the testing of structural elements in a wide range of test velocities and temperatures.

#### Technology Keywords

Aeronautical technology; Aircraft; Helicopter; Aerospace technology and exploration  
Simulation and engineering simulation; Composite Materials

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