

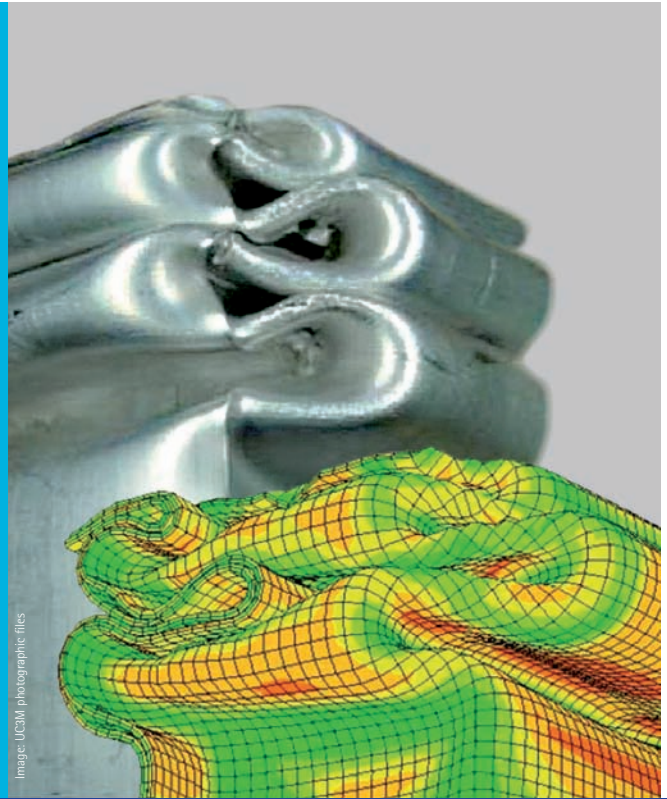
# MMCYTE

CONTINUUM  
MECHANICS AND  
STRUCTURAL ANALYSIS  
DEPARTMENT

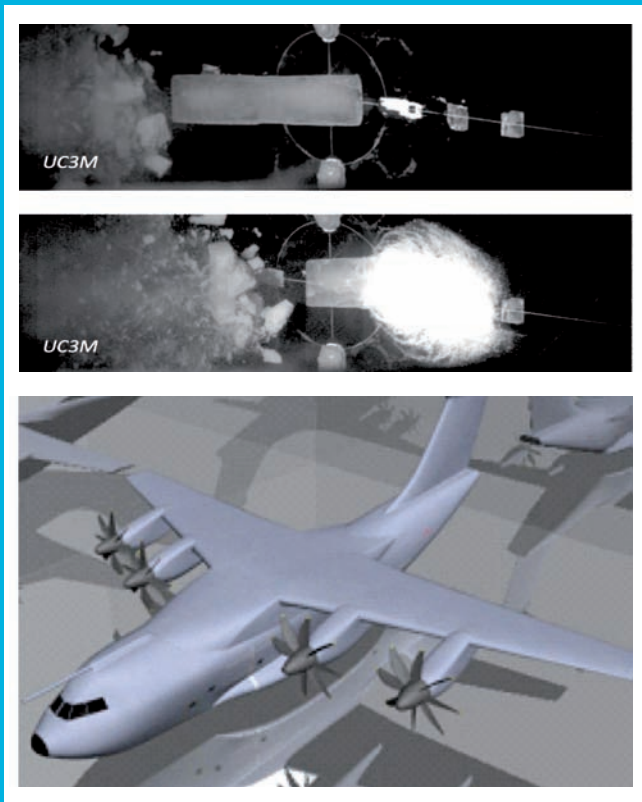
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*Impact sequence of an ice projectile at 150 m/s against composite barrier.*

The Department of Continuum Mechanics and Structural Analysis (MMCYTE) is formed by a consolidated multidisciplinary team of engineers with extensive experience in providing innovative solutions in both experimental and numerical analysis of the mechanical behaviour of solids, as well as in the adequacy of mechanical and structural components to in service conditions. MMCYTE provides service to the industry in those fields where knowledge of mechanical properties both in static and dynamic conditions (including impact problems) and at different temperatures is required.

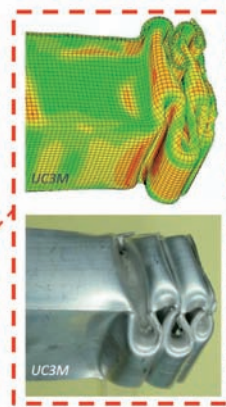
• RESEARCH LINES •

**Research Group:  
Dynamics and Fracture  
of Structural Elements**

*Person in charge: Dr. José Fernández Sáez*

- Dynamic behaviour of structural elements: experimental simulation and analysis.

- Structures for energy absorption.
- Constitutive models for materials at high strain rates Fracture mechanics.
- Damage mechanics.
- Dynamic fracture testing.
- Thermomechanical behaviour of materials.
- Residual stresses in structural elements.



*Ensayo y simulación numérica de elementos estructurales para absorción de energía a baja velocidad de impacto (Crashworthiness).*

**Research Group:**

**Mechanics of Advanced Materials**

*Person in charge: Dr. Enrique Barbero Pozuelo*

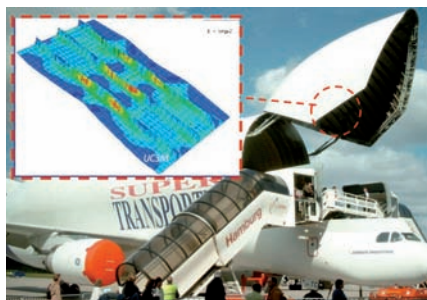
- Analysis and modelling of laminated and sandwich type structures subjected to high and low velocity impulsive loads.
- Analysis and modelling of composite structures for energy absorption.
- Damage tolerance study of composite structural element subjected to different load conditions.
- Innovation and development of non-conventional methodologies for structural elements subjected to impact loads, with special emphasis on damage tolerance evaluation.
- Experimental modelling and analysis of the mechanical behaviour of composites in dynamic conditions.

### • OUTSTANDING COLLABORATIONS AND R&D&I PROJECTS •

The MMCYTE collaborates in activities of consultancy, design and implementation of solutions related to the mechanical behaviour of components and the calculation of structural elements. To that end, it provides mechanical testing services for components and structural elements at different strain rates and at different temperatures, and it has specific experience in the field of dynamic and impact testing. It has a wide range of mechanical testing equipment, some being the only of its kind available in Spain. It also has extensive experience in solid mechanics modelling by means of self-developed tools and by using commercial numerical codes.

It has worked and maintains regular collaborations with high-tech companies from the aeronautic sector such as Airbus Espa-

ña, Airbus Military, Aernnova Engineering and INTA, and from the automotive sector such as Volvo España, Applus+IDIA-DA and VTI.



*Numerical simulation of the dynamic behaviour of rigidized panels.*

### • INNOVATIVE TECHNOLOGICAL SOLUTIONS •

The following stand out among the innovative technological solutions offered by the Department:

- Analysis of aeronautic and aerospace structural element behaviour against impact.
- Development of specific methodologies for the study of tolerance to damage against different load conditions of aeronautic and aerospace structures made of composites.
- Safety and defense of mobile systems subjected to impact loads.
- Analysis and modelling of lightweight structures subjected to impact loads.
- Energy absorption testing.



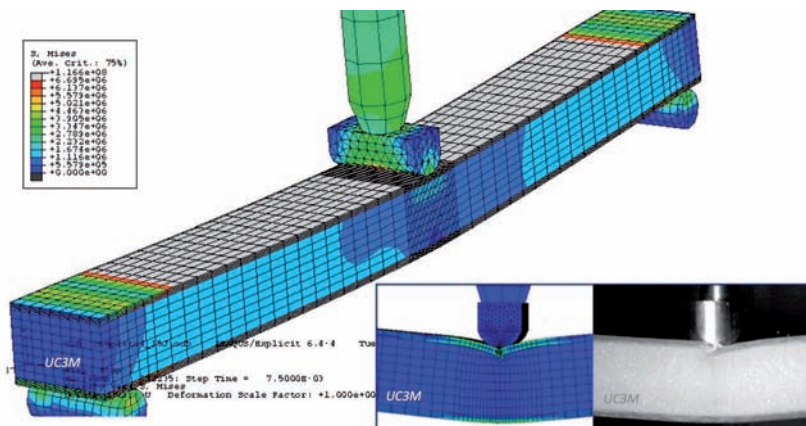
*Simulation of a high-velocity impact on carbon fiber laminate.*

### • TECHNOLOGICAL EQUIPMENT •

- **Mechanical Characterization Laboratory (LabMec).** The experimental equipment of the research Groups forms part of the LabMec, belonging to the Laboratories Network of Community of Madrid. It has advanced equipment for the dynamic characterization of materials in static and dynamic conditions, at strain rates up to  $2000\text{s}^{-1}$  and at temperatures ranging from  $-150\text{ °C}$  to  $1200\text{ °C}$ .
- Pneumatic launchers to perform high-velocity impact (up to 15 kJ and 1000 m/s).
- Pneumatic ice projectile launcher for high-velocity impact (up to 6 kJ and 250 m/s).
- Instrumented Charpy pendulums (50 J and 300 J).
- Hopkinson bars (traction, compression, bending).
- Instrumented drop weight towers (up to 2000 J).

- Universal high-velocity testing machine (100 kN and 20 m/s).
- Universal testing machines (100, 250, 1000 kN).
- Climate chambers for tests at low and high temperature ( $-150$  to  $1200\text{ °C}$ ).
- Ultra high-speed photography cameras (up to 250000 images/second).
- High-rate data sampling acquisition systems.

- Extensometry equipment.
- Non-destructive inspection equipment (A-Scan, C-Scan).
- **Numerical Simulation Laboratory,** has work stations and commercial codes for numerical modelling (ABAQUS/Standard, ABAQUS/Explicit, LS-Dyna, Autodyn-2D, Autodyn-3D).



*Simulación numérica de un ensayo dinámico de flexión en tres puntos sobre una viga sándwich.*

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IMAGE OF COVER: *Numerical testing and simulation of structural elements for energy absorption at low velocity impact (Crashworthiness)*