



OO/UC3M/56- SECURITY AND DEFENCE OF MOBILE SYSTEMS UNDER IMPACT

The Group “Dynamics and Fracture of Structural Elements” offers its experience in Solid Mechanics analysis for the study of the impact protection of vehicles, aircrafts and persons. The Group activities have a strong research component, in which numerical simulation tools as well as sophisticated experimental techniques are employed. This technological offer could be of interest to automobile companies (impact and collision security), aeronautical companies (impact of external body on fuselage, attack, and fragments o ice) and defence companies (special armours for mobile systems and persons).

Description and special features

The Research Group “Dynamics and Fracture of Structural Elements” is formed by engineers of different specialities. They have a large experience in the analysis of the mechanical, impact and fracture behaviour of mechanical and structural elements. The members handle both experimental and numerical simulation methodologies. The activities of the group are developed in connection with research and development projects financed by public institutions, and with projects financed by external companies. Research and technological results have great interest for automobile and aircraft companies related to security and structural protection.

The Group points its activities to the direct application to the industry and other related to generation of technological and scientific knowledge. The technology offer related with security and protection of structures and persons reach:

- Structures for energy absorption
- Structures for impact protection
- Constitutive models for materials at high strain rates
- Fracture and damage mechanics
- Dynamic Fracture testing
- Thermomechanical behavior of materials
- Metal matrix composites

To develop this technological offer, the Group has experimental facilities, some of them unique in Spain, which allow performing different types of mechanical testing (impact, tension, compression, bending, and fracture) within a wide range of strain rates and temperatures. The Group also has commercial and self-made simulation tools, which allow predicting the behavior of solids and structural elements.

The facilities to perform experimental testing are:

- Pneumatic launchers to perform high speed impact (up to 10000 J and 1000 m/s)
- High speed Cameras (250000 frames per second)
- High sampling rate data acquisition systems
- Instrumented Charpy pendulum
- Hopkinson bars (tension, compression, bending)
- Instrumented drop weight towers (up to 2000 J)
- High velocity universal testing machine (100 kN)
- Universal testing machines (100, 250, 1000 kN)
- Climatic chambers and furnaces for low and high temperature testing
- Extensometry systems



The Group also has commercial Finite Element codes of general propose and specific for impact problems (ABAQUS/Standard, ABAQUS/Explicit, LS-Dyna, AUTODYN-3D) installed in high-performance computers.

The relations with technological industries and prestigious groups of other research center and Universities are promoted by the Group. The Group communicates its results in refereed journals –indexed in the ISI database-, as well as in national and international scientific conferences.



Left: Numerical simulation of the crash process resulting of the impact of an aluminium tube of a vehicle structure. Right: Impact sequence of the impact of a projectile onto an aluminium tank containing fluid (600 m/s).

Innovative aspects

Application of advanced numerical tools to the analysis of impact problems and to the optimization and analysis of armor in conjunction with the performance of singular experiments carried out in unconventional test machines.

Competitive advantages

The group has simulation tools and experimental facilities to accomplish complex analyses of the behavior of structural elements subjected to impulsive loads.

Dramatic increase of early detection probability greatly reducing false alarm rate compared to current systems.

Technology Keywords

Design and Modelling / Prototypes; Metals and alloys; Composite materials; Design of vehicles; Aircraft; Simulation, Simulation Engineering

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