

Collisioni, danneggiamento, cambiamento di fase: meccanica irregolare,

Thermo-mechanical phenomena in engineering sciences involve sudden changes: a cable can break, a rock can descend a slope quickly and destroy a protective concrete wall and being also severely or not damaged, a liquid can solidify, a wave can hit violently a wave breaker or a diver can make a belly flop. All these phenomena involve discontinuities either with respect to time or with respect to space of the quantities that describe at the macroscopic level the materials or the structures. The lectures intend to investigate the elements which are common to all these phenomena, to study various examples and to describe applications in engineering.

The common elements are the subject of the introduction that regroups some mechanics recalls and the rapid description of some notions, mainly of convex analysis, useful to work with quantities that can be discontinuous.

One studies the damage of materials and structures then. Damage is due to micro-cracks, to micro-cavities, that result at the macroscopic level in the progressive loss of structural capacities. Macroscopic predictive theories are established with applications to engineering.

Phase transitions solid-liquid, solid-solid,... modify deeply properties of materials. These changes can be dissipative, non dissipative, irreversible. They are studied, always at the engineer's level: that is to say on a macroscopic scale.

Collisions, collisions of rigid solids (balls, granular materials, rocks avalanches), collisions of deformable solids, collisions of solids and liquid are then investigated. The collisions may be so violent that the solids fracture: fracturation and collisions are also investigated.

Practical and numerical exercises will be available to the students.