

REVOLUTIONARY DEVICES TO DISSIPATE ENERGY IN MECHANICAL SYSTEMS

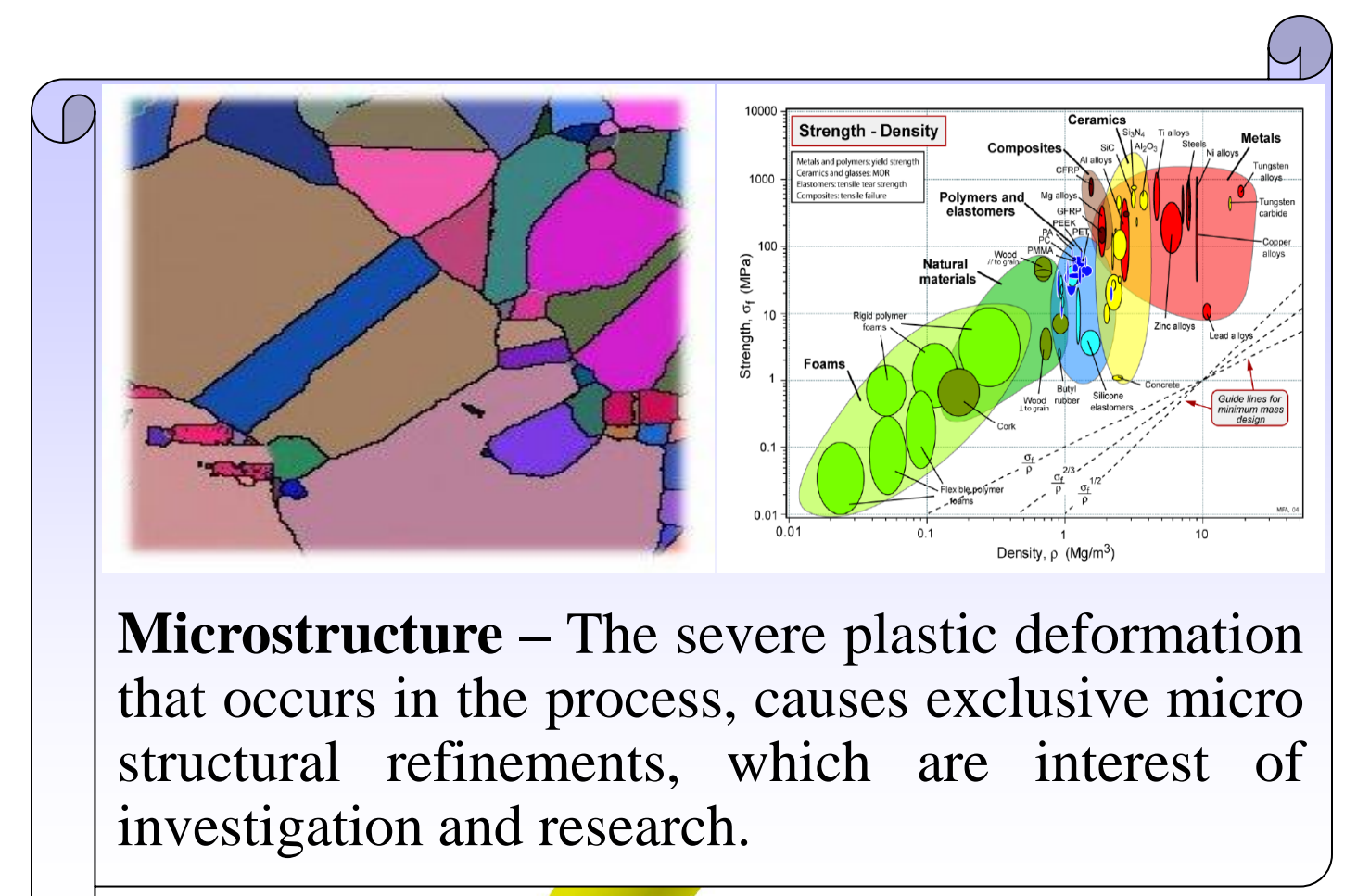
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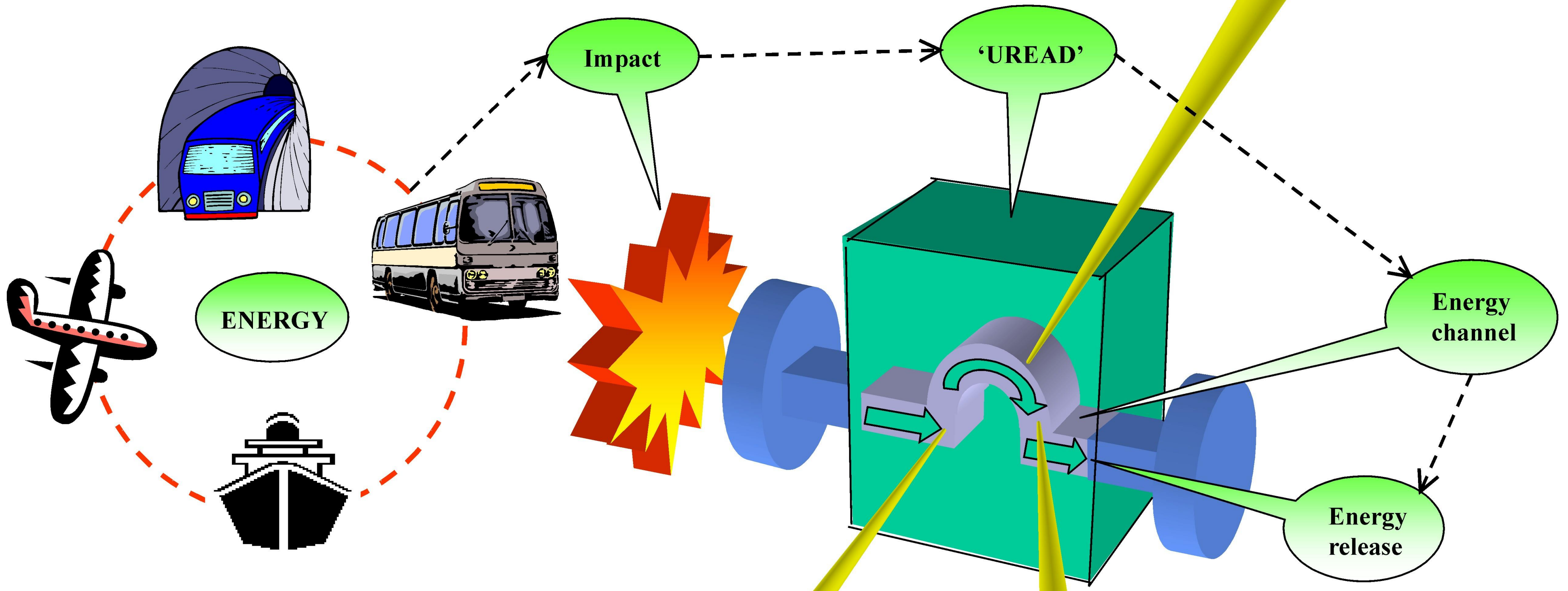
Introduction - The fast development of modern technologies in most fields is certainly driven by inventions and discoveries that changed the shape and operations of every day objects. The power and performance of energy sources has increased exponentially in the last two decades, and scientists always put considerable efforts on the most efficient way to produce and apply energy to new devices. However, in some instances, when energy is released unexpectedly it needs to be dissipated in such a way to prevent injuries and disasters. Car accidents, or the action of natural release of energy such as earthquakes and tsunamis, may occur without warnings.

Dissipating unwanted energy is in general a very critical field, that certainly requires more knowledge, investigations, and full-scale experimentation. In order to provide a higher level of protection to current and future general structures, research into solutions that eliminate most of the disadvantages of current arrangements is essential. Most current devices usually get destroyed on impact, or in other cases, they lack flexibility and cannot easily be incorporated into structures and design.

Revolutionary energy absorbers: UREAD devices - In this presentation, a novel technique to dissipate unwanted energy in engineering systems is introduced. The idea is novel, and may lead to innovative designs of Universal Re-usable Energy Absorption Devices (UREAD). A unique shearing process that is found in special extrusion processes of deformable solid materials through intersecting channels of equal cross sectional area. The application of this method includes automotive, aerospace, structural protection, personal safety and practical use.



Project Explorations

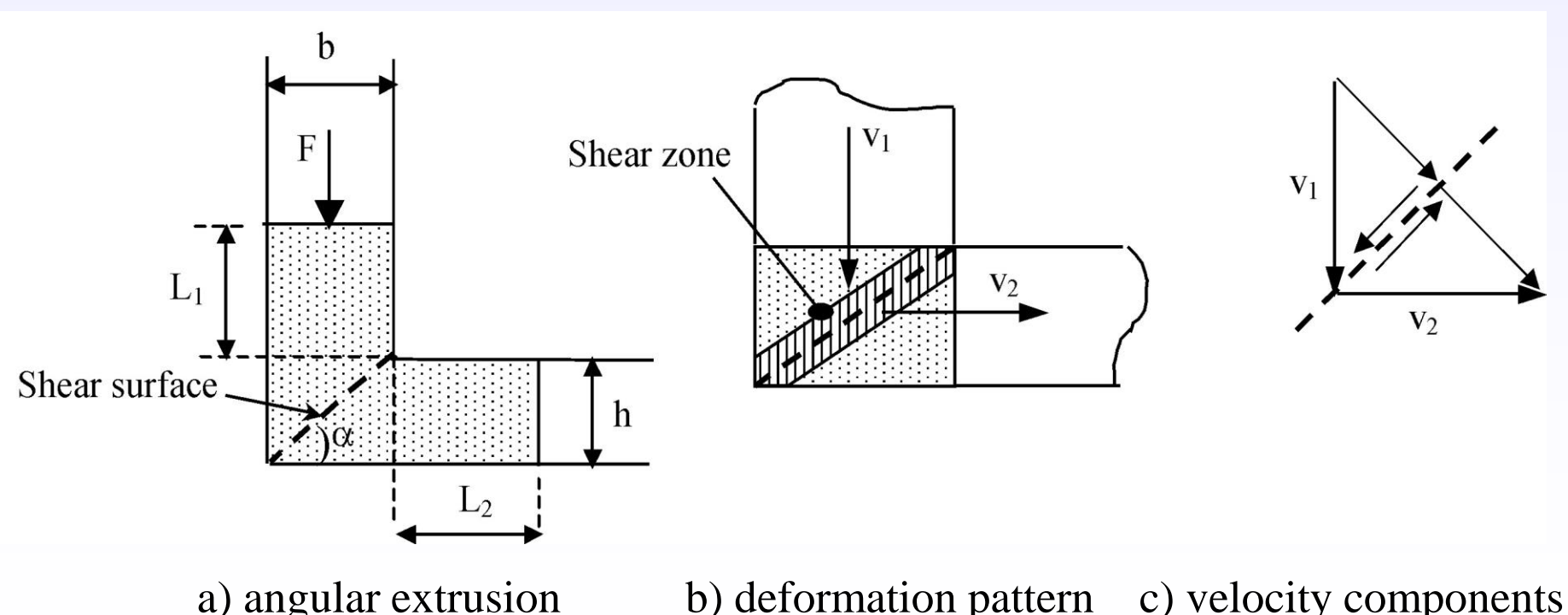


Energy Dissipation Mechanism

A new potential way to dissipate energy, that can combine all advantages of energy absorption due plastic deformation and total reusability, is the use of constant dimensionless change deformation concept. Specifically, if a solid billet is pushed within a tool and through a passageway of a constant cross section area, energy will be absorbed along a shearing process caused by plastic deformation. It is clear that for this design, the billet can be moved forward and backwards through the channel, and has a potential infinite reusability. In practice, by forcing a solid material to deform as it passes round a bend in a closed channel, it is possible to construct a Universal Re-usable Energy Absorption Device (UREAD), capable of dissipating unwanted energy.

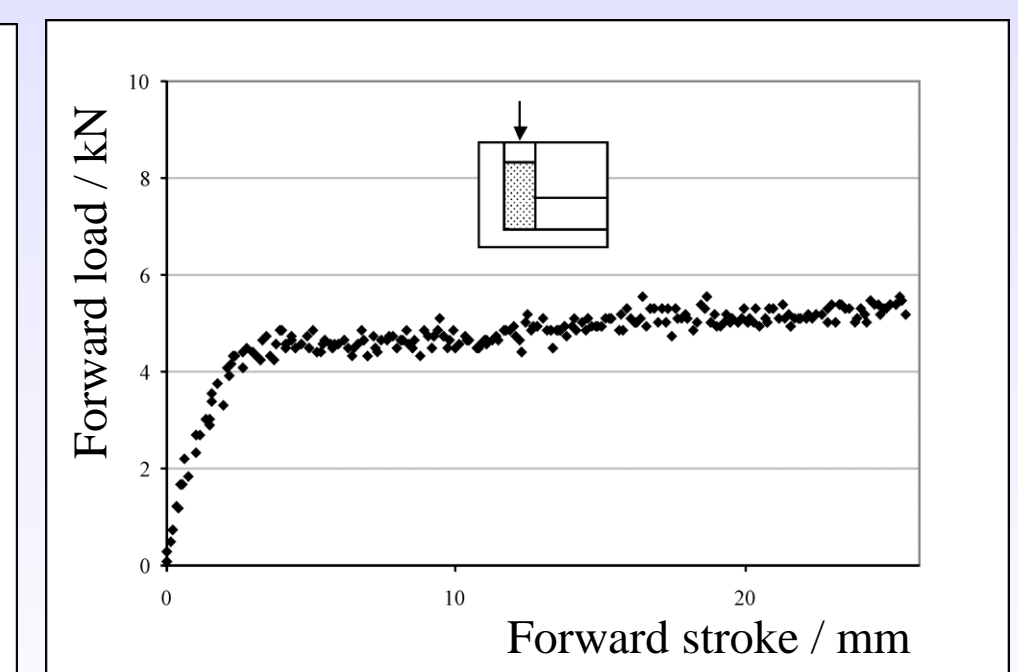
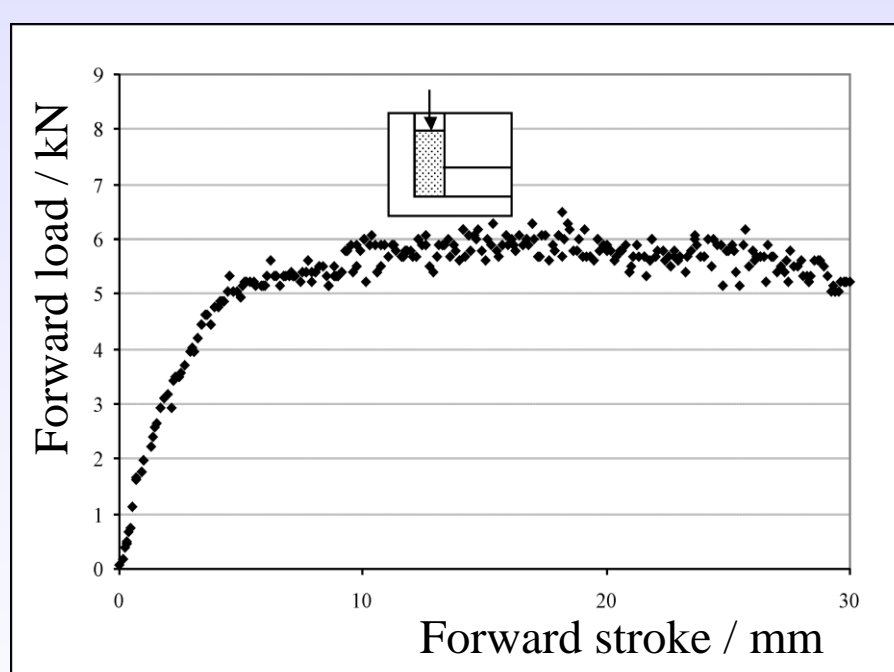
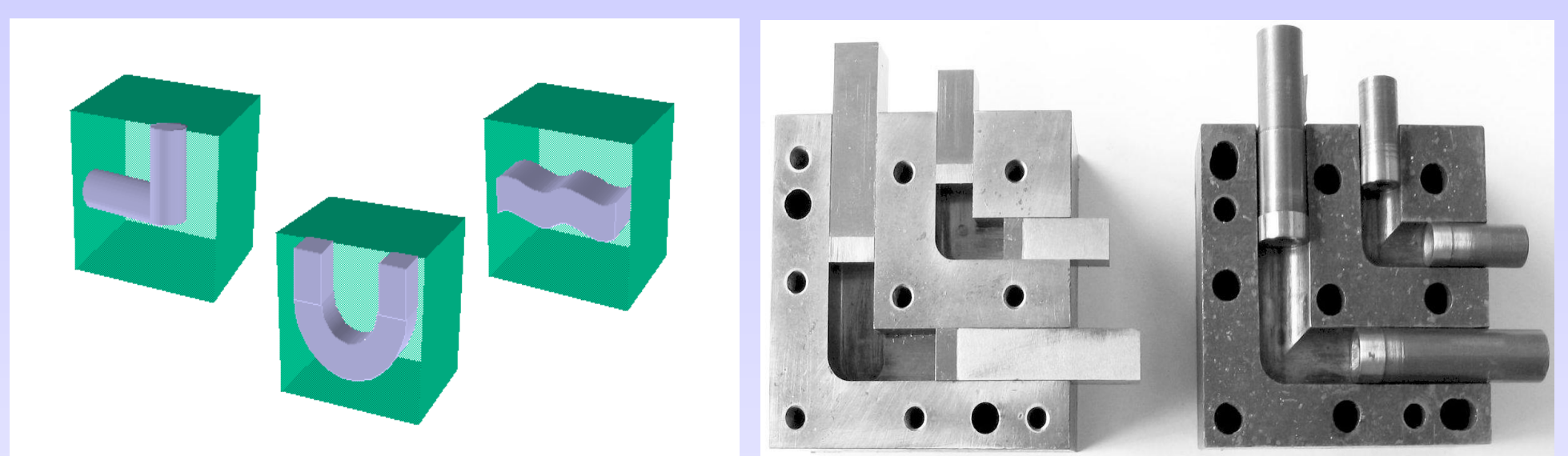
Energy Dissipation Analysis

When a deformable billet is forced to flow through inclined channels, the material velocity changes direction, therefore relative motion develops. Hence, energy is dissipated.



Configuration and Performance

Channels geometry and devices construction can be variously designed, in order to perform different behaviours and be tailored to energy dissipation requirements.



Pointers

Energy dissipation devices based on such technology would be reusable, simple to use, easy to manufacture, maintenance free, easy to integrate into any structure, low cost and with large range of possible force ratings.