invited lecture at MDA2024, Porto, Portugal, 4-5 July 2024

No risk no progress - a quick tour focusing on materiais and structures

Paulo M. S. T. de Castro
Universidade do Porto
Faculdade de Engenharia
Rua Dr. Roberto Frias
4200-465 Porto
Portugal

Abstract

Starting by reference to the Farmer's diagram and its origin associated with the early steps of the civil nuclear industry, the notion of risk - a measure of the likelihood that damage occurs as a result of a particular hazard – will be discussed in this presentation. Important problems to be avoided or mitigated in materials and structures are related to damage, including sudden occurrences as brittle fractures or time-dependent phenomena as fatigue. Fracture Mechanics emerged in last century as an indispensable tool to deal with those problems, and no wonder that was early appreciated by the technical and the insurance communities. Some aspects of Fracture Mechanics methodologies will be recalled, including round robin programmes, or the occasional interest for self-healing materials. Examples of the use of Fracture Mechanics for failure analyses and fracture avoidance will be discussed through cases chosen from a variety of contexts, from old metallic bridges to current large passenger aircraft. Trends for sustainability will be mentioned, particularly the emergence of the notion of digital twin with application in a variety of fields as aeronautics and civil engineeering structures among others.