9th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMA2024)
June 3-7, 2024, Lisbon, Portugal

FRACTURE AND DAMAGE IN MULTIPHYSICS PROBLEMS ACROSS MULTIPLE SCALES

TRACK NUMBER 1600

EMANUELA BOSCO[*], LEONG HIEN POH[†] AND EMILIO MARTINEZ-PAÑEDA[‡]

[*] Eindhoven University of Technology
Groene Loper 3, 5612 AE Eindhoven, The Netherlands
e.bosco@tue.nl

[†] National University of Singapore
Engineering Drive 2, E1A 07-03, Singapore 117576, Singapore
leonghien@nus.edu.sg

[‡] Imperial College London
Skempton Building, Imperial College Rd, London SW7 2BB, UK
e.martinez-paneda@imperial.ac.uk

Key words: : Multiphysics, Multiscale, Computational modelling, Fracture, Damage

ABSTRACT

This mini-symposium focuses on recent developments in computational strategies to predict fracture and damage processes in multiphysics environments across multiple length scales. Predicting material degradation and failure presents significant challenges in computational mechanics, particularly when these phenomena are governed by the coupled effects of multiple physical processes, such as changes in temperature, moisture, electric fields, magnetic fields, and chemical potentials. Additionally, many material systems exhibit an inherently multiscale nature, where the interaction between material behaviour at different length scales triggers the fracture response at the macroscopic level.

The relevance of these computational strategies extends to a wide variety of applications, ranging from technical engineering scenarios (e.g., the chemo-mechanical corrosion of cementitious materials and the electro-chemo-mechanical fracture of Li-ion batteries) to, surprisingly, cultural heritage materials (e.g., the hygro-chemo-mechanical degradation of historical paintings). In this mini-symposium, the underlying common features between these different classes of applications, which are typically poorly appreciated and exploited, will be strongly emphasised. This will provide the opportunity to gather and profit from the advances made in different research communities.

The mini-symposium will cover a broad range of research areas related to computational strategies for fracture and damage processes in multiphysics simulations, possibly exploring the incorporation of multiscale models and numerical techniques capable of capturing different length scales. This includes (but is not restricted to) the following topics:

- Thermo-hydro-chemo-mechanical problems
- Diffusion-reaction processes

- Chemically induced corrosion
- Active magneto-electric materials
- Thermodynamically consistent models
- Application of machine learning in multiphysics and multiscale modelling
- Integrated numerical-experimental strategies for multiphysics processes