THEMATIC SYMPOSIUM

Artificial Intelligence and Physics-based Numerical Methods for Fracture and Fatigue Damaging Processes

Chairs: A. Tridello[a], E. Salvati[b]
[a] Department of Mechanical and Aerospace Engineering, Politecnico di Torino, 10129 Turin, Italy, andrea.tridello@polito.it
[b] Polytechnic Department of Engineering and Architecture (DPIA), University of Udine, Udine, Italy, enrico.salvati@uniud.it

The use of Artificial Intelligence (AI) in the structural integrity context has significantly increased in the last years and is expected to play a major role in the future. For example, Machine Learning (ML) and data-driven techniques, branches of AI, can provide reliable support for the design of structural parts or for monitoring the health state of components in in-service conditions. Moreover, AI can help speed up simulation processes and properly and efficiently manage multivariate complex problems whose solutions cannot be found with "traditional" design tools.

When experimental evidence is either absent or incomplete, required datasets to train AI-based models are often scavenged through the exploitation of numerical approaches, relying on physics laws or semi-empirical laws. Therefore, reliable and robust numerical methods, often computationally demanding, must be continuously developed to tackle several challenges in complex and highly inhomogeneous materials and structures. Some approaches to simulate fracturing processes and fatigue damage can meet this rising demand, i.e., Phase-Field, Peridynamics, XFEM, CZM, etc.

This symposium aims to bring together researchers employing advanced computational methods to tackle outstanding structural integrity problems. Applications of AI and implementing data-driven techniques are highly welcome, including physics-based numerical approaches and their combination. Research activities with consolidated results, as well as preliminary research with promising outcomes, are appreciated. This symposium will provide an overview of the current state-of-the-art scientific knowledge on AI and Structural Integrity and it also aims to stimulate ideas for future research in this emerging field.

The thematic symposium is co-organised by Enrico Salvati (University of Udine), Principal Investigator of the project PRIN 2022, Prot. n. 20229BM9EL, entitled "NUmerical modelling and opTimisation of SHELL Structures Against Fracture and Fatigue with Experimental Validations (NutShell)". Public notice n. 104/2022 of 02/02/2022. CUP G53D23001140006.
The objectives of the project are aligned with *Piano Nazionale di Ripresa e Resilienza* (PNRR) - Mission 4: *Istruzione e ricerca, Componente 2: Dalla ricerca all'impresa, Investimento 1.1: Fondo per il Programma Nazionale della Ricerca (PNR)* and *Progetti di Ricerca di Rilevante Interesse Nazionale (PRIN),* Funded by the European Unin - NextGenerationEU.
The symposium is going to showcase the outcomes of the project, along with other independent contributions in the fields of AI and computational Fracture and Fatigue Mechanics.