Title:  ***Phase field modelling of multi-physics problems: Li-Ion battery degradation, corrosion and hydrogen assisted failures***

Material degradation challenges at the interface between mechanics, chemistry and materials science are hindering the energy transition. Examples include the degradation of Li-Ion batteries, the embrittlement of metals exposed to hydrogen, and the early cracking of offshore wind turbines due to corrosion. New experimental insight, increasing computer power, multi-physics modelling paradigms and the development of techniques capable of handling evolving interfaces (e.g., phase field) have opened new horizons in the simulation and prediction of these technologically-relevant phenomena. In this talk, I will overview some of our recent work in developing theoretical and computational models capable of predicting degradation phenomena in the areas of hydrogen assisted cracking, Li-Ion batteries (conventional and all-solid-state) and metallic corrosion. Emphasis will be placed on the development of new electro-chemo-mechanical schemes that can explicitly simulate the underlying physical processes. Also, I will showcase how phase field methods enable predicting complex interfacial phenomena: from fracture mechanics to corrosion. The predictive capabilities of these formulations will be showcased by benchmarking against experimental data. Large-scale case studies of engineering interest will also be addressed to demonstrate the potential of phase field multi-physics modelling in enabling *Virtual Testing* in the energy sector.



Bio: *Prof Emilio Martínez-Pañeda is an Associate Professor in Engineering Science at the University of Oxford, where he leads the Mechanics of Materials Lab. Prior to joining Oxford, he was a Reader (Associate Professor) at Imperial College London, where he led an interdisciplinary research group from 2019 to 2023 (2019: Lecturer, 2021: Senior Lecturer, 2023: Reader). Before joining Imperial, he was an 1851 Research Fellow at the University of Cambridge. Prof Emilio Martínez-Pañeda’s research spans a wide range of topics within computational mechanics, from the prediction of crevasse growth in large ice-sheets to the micro-scale modelling of battery materials. He has been the PI on over £4.5M of funding in the past five years (ERC, UKRI) and his work has been recognised through multiple awards, including the 2021 UK Young Engineer of the Year (Royal Academy of Engineering), the 2022 Imperial College President’s Medal for Excellence in Research (Early Career), SEMNI’s Simo Prize, Spain’s Royal Academy of Engineering Young Investigator Medal and the 2021 Gustavo Colonnetti Medal (RILEM).*

**Date : 23th November 2023**

**Time: 2:30pm-4:00pm**

**Room – School of Management 113, Bay Campus**