KTH SOLID MECHANICS SEMINAR; Thursday, December 12th, 16.15; https://kth-se.zoom.us/j/5775210342

David Morin
"From micro-mechanics to structural mechanics: Application to thin-walled metallic automotive parts"

Modeling ductile failure in automotive applications is critical for ensuring vehicle crashworthiness. Currently, plasticity and failure in thin-walled metallic parts are modelled using coarse shell element meshes to meet the time-step requirements of large-scale crash simulations. While this discretization is standard in industry, advanced fracture models are often necessary to accurately predict ductile failure initiation and crack propagation in load-bearing components. However, such models, despite their predictive capabilities, frequently involve complex calibration procedures requiring multiple material tests, leading to higher costs and limiting their practical adoption. From an academic perspective, modelling of ductile failure remains an important topic. Advanced micro-mechanical models, such as unit-cell analyses, strain localization analyses, porous plasticity models, are common and have been used to increase our understanding of ductile failure. In this seminar we propose to use a micro-mechanical approach, specifically strain localization analysis, to calibrate a relevant crash-oriented ductile failure model. The lecture will cover the theoretical foundations of strain localization analysis as well as a dedicated validation strategy derived to assess the accuracy of the proposed calibration approach. This approach aims to bridge the gap between academic insights and practical engineering applications, facilitating more efficient and reliable modeling of ductile failure in crash scenarios.

Dr. Morin is currently an associate professor at the Department of Structural Engineering, NTNU. After earning his PhD from the University of Valenciennes et du Hainaut-Cambresis (France) in 2010, he moved to NTNU as a post-doctoral fellow. In 2012, he became PI and head of the Connectors and Joints research programme in SFI-SIMLab. He became an associate professor in 2016. From 2015 to 2023 he was involved in SFI-CASA (2015-2023) as PI and head of the programme Structural Joints as well as the industrial implementation programme in the last year of the centre. His expertise and interest in research are closely related to the field of computational mechanics. His research is oriented along three main axes with the modelling of materials, joints and structures subjected to large strain and impact scenarios.