LMS Seminar

If images could talk: An image-based approach for characterizing dynamic responses in solid mechanics

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Date and Time: October 16, 2025 (2 – 3 pm)

Venue: Amphi 104 (Pole Meca)

Abstract

Over the past four decades, numerous image registration methods have been developed to capture complex kinematics: in 2D, on deforming 3D surfaces, in volume (3D), resolved in time, or even both at once (4D). Among these, random speckle–based techniques such as Digital Image Correlation (DIC) has proven particularly effective in complex experimental scenarios: it relies on white light, is easy to implement (e.g., spray-paint), remains applicable at high temperatures (up to 1000 K), and can achieve sub-micrometric resolution.

When coupled with image-based inverse methods - such as FEMU, VFM, or, more recently, non-parametric data-driven identification (DDI) approaches - DIC enables the use of sophisticated test configurations and loading conditions, providing both robustness and efficiency in material characterization. In particular, recent advances in ultra-high-speed imaging have opened new possibilities for probing the dynamic response of materials, which is particularly relevant when extreme deformations trigger transient responses, localization mechanisms, or material instabilities. However, until recently, spatial resolution remained a major limitation to fully exploiting such imaging capabilities. This talk will present recent developments in high-spatial-resolution ultra-high-speed (HR-UHS) imaging, combined with DIC and inverse methods, and will illustrate recent achievements in characterizing dynamic material responses in different contexts, including fracture dynamics in brittle materials and rate-dependent behavior in metals.

About the speaker

Dr. Seghir is a CNRS researcher at the Institut de Recherche en Genie Civil et Mécanique (GEM), Ecole Centrale Nantes, France. He received his PhD in 2012 from the Ecole Centrale de Lille, on the topic of thermomechanical coupling in metallic polycrystals. He develops full-field measurement techniques and experiments to study the thermomechanical behavior of metallic and polymeric materials. More recently, his research has been focused on identifcation of dynamic properties through full-field ultra-high speed imaging and inverse methods.

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