Séminaire du laboratoire PIMM

Mercredi 13 juillet 2022 à 13h30 amphi Esquillan

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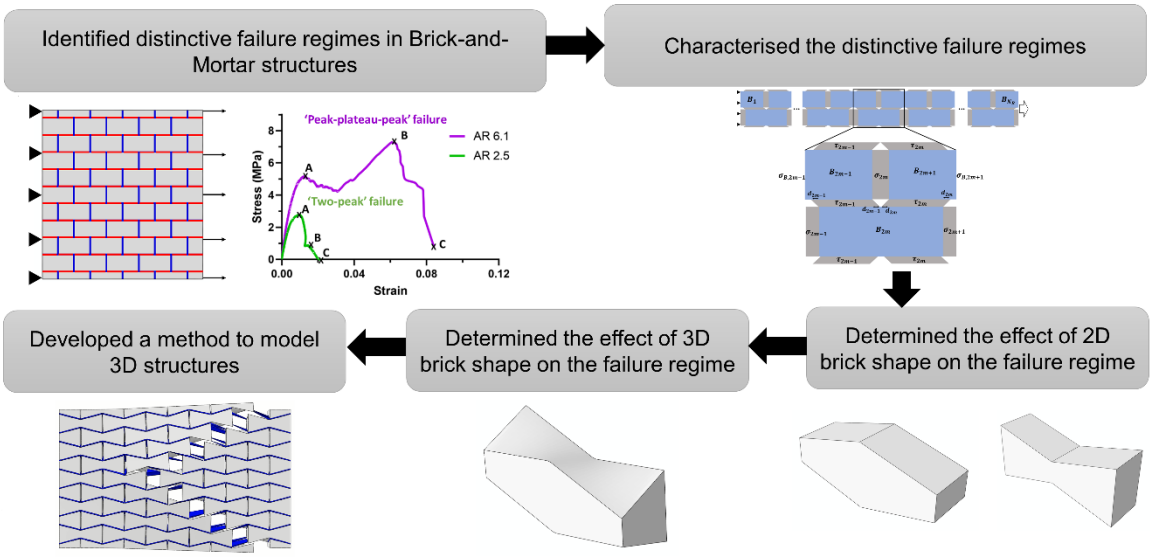
présentera dans le cadre du séminaire ces travaux intitulés :

Modelling and Design of Additive Manufactured rick-and-Mortar Structures

Brick-and-Mortar structures have been shown to exhibit exceptional combinations of properties, as well as a highly tuneable response. These types of structures therefore have considerable potential for a broad range of applications. To effectively design with these types of structures we need to comprehensively characterise their structure-property relationship. While there has been some work done in this space, the property maps are still incomplete, particularly within the 'layer-only' failure regime and for non-planar brick geometries. Due to the vast array of structure parameters in the Brick-and-Mortar structure this can only be efficiently understood if we pair fabrication methods, such as multi-material Additive Manufacturing, with efficient models.

In this work[1] we have utilised Additive Manufacturing and identified the existence of two different failure regimes in the Brick-and-Mortar structure, namely a 'two-peak' and a 'peak-plateau-peak' failure regime, differing in the ability of the structure to distribute damage. These regimes were further investigated and mapped out using a new finite-sized micromechanical-based semi-analytical model that utilises the Cohesive Zone Model. This model demonstrates the importance of considering the finite size of the structure as well as the inherently flawed nature of the structure, when modelling its mechanics. Theoretical predictions from the model suggest that the failure regime can be controlled by tuning either the aspect ratio of the bricks, tuning the relative shear and normal layer materials or tuning the shape of the bricks. These trends are confirmed experimentally by testing Brick-and-Mortar structures fabricated with multi-material Additive Manufacturing. The model, and the corresponding experimental tests, further identifies that a transition from the 'two-peak' to the 'peak-plateau-peak' failure regime significantly increases the toughness of the structure without compromising strength or stiffness of the structure, highlighting the importance of understanding and controlling these regimes.



[1] References: G. Hunter et al. Controlling failure regimes in brick-and-mortar structures, *Extreme Mechanics Letters*, 51. 101596 (2021) G. Hunter et al. Effect of angled layers on brick-and- mortar structures, *Materials & Design*, 110680 (2022)