Doctoral School MEGeP
« Mechanics, Energetics, Civil Engineering,
Process Engineering »

Thesis proposal for a Doctoral position 2017-2020

PhD title	Test optimization methodology for the identification of constitutive parameters based on full-field optical measurements
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Context and problem definition

Design of structural components more and more rely on the so-called *virtual testing*. The predictability of modeling therein strongly depends on the experimental identification of the parameters which govern the mechanical constitutive equations. Thus, an approach capable to evaluate them both accurately and efficiently is of key importance.

Modern standard [1] for identifying constitutive parameters relying on full-field optical techniques (among which Digital Image Correlation plays a growing role in experimental mechanics) showed to be the most promising way for identifying a number of constitutive parameters with one single test.

With existing identification techniques, there is often a significant covariance of the identification parameters. Given a constitutive model, designing an experiment (shape of the specimen, loading...) permitting to accurately evaluate all its parameters at the same time is not an easy task [2]. Namely, improving the quality of identification of one parameter may degrade that of another. The key problem of the experiment design turns around the definition of a relevant optimization criteria.

Objective

The objective of the PhD project is the development of computational approach which optimizes the shape of the testing specimen as well as the boundary conditions and possibly the loading regime. The criteria for this optimization are based on improvement of the identifiability of constitutive parameters related to a given constitutive law. We seek here to reduce the identification uncertainty of all of the parameters to be determined decreasing at the same time their correlation.

Application

The starting point considers topological optimization of standard uniaxial test specimens made of fiber composite material. Envisaged future application aims towards nonlinear elastoplastic constitutive models and arbitrary topological properties of the testing specimen.

References

[1] S Avril, M Bonnet, A-S Bretelle, M Grédiac, F Hild, P Ienny, F Latourte, D Lemosse, S Pagano, E Pagnacco, F Pierron, (2008). Overview of Identification Methods of Mechanical Parameters Based on Full-field Measurements, *Exp. Mech*, 48:381–402.

[2] Bertin, M. B. R., Hild, F., and Roux, S. (2016). Optimization of a cruciform specimen geometry for the identification of constitutive parameters based upon full-field measurements, *Strain*, 52(4):307–323.