Ecole graduée

Sciences de l'Ingénierie et des Systèmes

EGENGSYS

Titre Thèse (subject)	Development of an equal-biaxial fatigue testing device for highly deformable materials and validation of multiaxial fatigue life criteria for elastomers	
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Financement prévu ☒	Contrat Doctoral Etablissement ☒ Région ☐ – Autre ☒ Contrat de recherche ☐ Préciser :	ULille ☒ UPHF ☐ Centrale Lille ☐ UGE ☐ IMT ☐ Autre ☒
Financement acquis ? ☐	Contrat Doctoral Etablissement ☐ Région ☐ – Autre ☐ Contrat de recherche ☐ Préciser :	ULille ☐ UPHF ☐ Centrale Lille ☐ UGE ☐ IMT ☐ Autre ☐

Résumé du sujet (abstract):

Context: Due to their special mechanical properties, in particular their ability to undergo large deformations on the one hand, and to dissipate energy on the other, filled elastomers are increasingly used in many industrial fields, particularly in the transport sector . When operating, most rubber components are subjected to multiaxial and non-proportional loadings, which can be cyclic or even random. To validate predictive life models, it is necessary to have experimental databases for these complex loading paths. However, the highly deformable nature of elastomers has not, to our knowledge, allowed equal-biaxial loading data to be made available, due to the lack of a suitable device. This is an experimental limitation that we wish to overcome in this work.

Work plan and objectives: the work will thus be carried out in 3 major stages. The first step will be to implement an equal-biaxial fatigue test device according to the design already carried out in the laboratory. The aim here is to validate both this design and that of the geometry of the samples to be tested by means of some numerical simulations. Once completed, the device will have to be tested and validated on a range of elastomeric materials to be defined.
In a second phase, a test campaign should be implemented on 2 materials already studied in the laboratory and thus enrich the database with these tests, which to our knowledge will be pioneering.
In the third stage, this complete database on two materials will enable the qualification of prediction models for the multiaxial fatigue life of elastomers. This will involve using models developed in previous works in our team, in particular the thesis work of G. Ayoub and A. Hottin. This validation could lead to possible modifications of the models, depending on the results obtained.

Reaserch team: The PhD thesis will start in October 2023 and will be carried out at the UML Laboratory. The PhD student will benefit from the existing cooperation with G.Ayoub, University of Michigan at Dearborn (USA).

Industrial support: The Trelleborg Group's Modyn company, Research and Innovations Department, is providing support by supplying materials for the experimental study.

Candidate : The candidate should have a strong interest in experimental aspects and in particular in mechanical testing. He/she should also have a good grounding in the mechanics of continuous media. Knowledge of large deformations framework is a plus. In addition, the use of programming languages (Python, Matlab, etc.) is required.

Application: Interested candidates should send their CV, a letter of motivation, and contact information of two references.