Université Bretagne Sud

Institut de Recherche Dupuy de Lôme
UMR CNRS 6027

Job offer for Post-doctoral fellow

Experimental and numerical studies of flax fiber based composites

Job Description

Composite structures are present in many areas that is to say water sports, ship-building, air- and railroad-transport, automotive industry and also leisure activities or renewable energies, for example wind turbines. The advantages of such structures lie in their vibration- and sound effect damping properties and their lightweight. Their "lightweight" is an appealing and attractive property for industrialization, especially in transport where it generates significant energy savings. This is a key-issue in a context where energy prices keep increasing and finite resource are gradually depleting.

There are several types of composites: man-made composites with carbon-, glass- and Kevlar- fibers and from now on, natural fiber composites with flax- and hemp-fibres. According to Fibre Research Development, in France, plant fibers harvest amounts to 180,000 tons per year. This is all the more interesting as they constitute a renewable and short circuit resource. Furthermore, it should be noted that the energy cost for manufacturing these composites is lower than that of the man-made composites. However, even if natural fibers represent the third fibre supply-source, their use remains moderate. Moreover, experimental and numerical studies of composite structures based on natural fibers are less numerous than for those made of carbon or glass.

The objective of this project is to meet this increasing demand from industrialists for bio-based composites by contributing to better understanding and modelling of the damping properties.

The post-doctoral researcher will have for mission to study on the one hand to variability of the material on the vibratory characteristics and on the other hand carbon / flax hybrids.

The variability study will be able to better control the uncertainties in order to improve the predictivity of the existing numerical model. The uncertainties related to composite materials based on flax fibers induce to take into account the variability of the influencing parameters of the composite, in particular the material properties, in the current deterministic model. The modelling becomes stochastic by considering certain uncertain parameters of the numerical model. The variability of these parameters will be defined by a Normal law. The propagation of uncertainties through the model will be carried out by a probabilistic approach in order to obtain an assessment of the variability of the model outputs. Monte-Carlo simulations are robust and expensive. An approach of this type combined with the hypothesis of modal stability will be used to greatly reduce the computation time. A database concerning numerous static and dynamic tests will allow the post-doctoral fellow to compare the variabilities measured experimentally and calculated numerically, in terms of vibratory response.

Carbon / flax composites will be studied numerically and experimentally. Conventional composites are used for its rigidity and damping characteristics. Introducing flax fibers instead of carbon fibers will reduce the weight of the structure and change their stiffness and damping characteristics. The objective here will be to study the influence of the layers of flax and to find a compromise between the rigidity of the structure and the damping. Different positions and different numbers of flax / epoxy layers will be tested experimentally and numerically. The damping characteristics and variability will be analysed.

The Bienvenüe grant aims to provide a better knowledge of the influence of the variability of the material on the vibratory characteristics of composites based on natural fibers and of the influence of the presence

of flax fibers in the composites initially 100% conventional fibers (carbon) for industrial applications: noise reduction by sound absorption in buildings, cars or military systems, etc.
The fellow will work on variability, hybrid composites, experimentally and with modelling and numerical simulation. The fellow will join a team dedicated to the study of the depreciation of bio-sourced structural damping with two permanent researchers, one post-doctoral fellow and one doctoral student. The team is working on the subject in collaboration with LEM3 (Metz) and Roberval (Compiègne) as a part of an ANR Bio-Damping project (National research program).

Main Research Field

Science and Engineering (ENG)

Key words

Composite structures, natural fibers, variability, vibration, experimental tests, numerical method, hybrid composites, damping

Department/Research: IRDL

Thematic : Sea engineering, composite materials, mechanics, …

Infrastructure available : experimental rooms, computers, computing softwares (Abaqus, Castem, LS-Dyna, …)

Website : http://irdl.fr/

Supervisors :

JM Cadou

Associate Professor in Université de Bretagne Sud (Lorient, South Brittany in France), research activities in numerical methods for nonlinear problems: fluid mechanics, solid mechanics, fluid structure interaction, stability analysis, supervisor of 10 PhD students, more than 30 papers in peer review journals.

L. Duigou

Assistant Professor in Université de Bretagne Sud (Lorient, South Brittany in France), research activities in numerical method applied in vibrations free or forced of sandwich structures with or not in fluid structure interaction. Supervisor of 3 PhD students.

Skills Requirements:

The candidate has to justify a competence in numerical programming methods, finite element method, non-linear problem , in composite materials, Variability ."

Publications: at least 1 per year since the PhD

Contract length : 24 months from a starting date in September 2021 at the earliest

Gross salary : 4200 euros

Contact :

Jean-marc Cadou : jean-marc.cadou@univ-ubs.fr
Laëtitia Duigou : Laetitia.duigou@univ-ubs.fr

Send your candidate file before December 10

Bienvenüe Project: https://www.europe.bzh

The BIENVENÜE post-doctoral program - “Welcoming highly-talented international post-docs in Brittany”, carried by Région Bretagne, in partnership with eight regionally implanted research institutions (universities and research centres), aims to recruit 75 post-doctoral fellows with a high-level international profile in Breton laboratories. It will be implemented over a period of 5 years from November 1 st, 2020 and is **co-funded by the European Union** through its Horizon 2020 research and innovation program.

Objectives The BIENVENÜE program aims at:

- reinforcing the human potential of Brittany’s research in the long term, by attracting high level international post-doctoral fellows with heightened conditions in terms of salary, working environment, training and networking;
- increasing the visibility and attractiveness of Brittany’s leading research and innovation domains;
- supporting the implementation of the Regional Research and Innovation Strategy – Breton RIS3 and contributing to the territorial development.

The BIENVENÜE post-doctoral projects should be built by the applicant, in relation with his/her supervisor. The applicant can freely decide on the thematic of his/her project, as long as it is in line with the strategic innovation areas of the Regional Research and Innovation Strategy – Breton RIS3.

The project must take place in Brittany. Post-doctoral applicant to be eligible, the applicant must, at the deadline of the call, be in possession of a doctoral degree or have at least 4 years of full-time equivalent research experience. He/she must also have resided or worked/studied at least 24 months outside of France in the 3 years immediately prior to the deadline.

Contact :

Jean-marc Cadou : jean-marc.cadou@univ-ubs.fr
Laëtitia Duigou : Laetitia.duigou@univ-ubs.fr