Université de technologie de Compiègne - Proposition de thèse

1re partie : Fiche scientifique	
Intitulé de la thèse	*Piezo-composite smart hybrid composite-metallic honeycomb sandwiches for aeronautic and space constructions*
Type de financement	Allocation MESR
Laboratoire d'accueil	Unité de recherche : Roberval Équipe de recherche : Matériaux & Surfaces Site web : https://roberval.utc.fr
Directeur(s) de thèse	Ayech Benjeddou, PU (ISAE-Supméca) rattaché à ROBERVAL
Domaines de compétence	Sciences pour l'ingénieur
Description du sujet de thèse	Hybrid (composite-metallic) honeycomb sandwiches are popular in modern aircraft and spacecraft constructions, where their cores are often in titanium, aluminum or NOMEX®, while their faces are in graphite-, carbon- or glass-epoxy multilayered or woven composites. Their modeling approaches can be grouped into: (i) *detailed* finite element (FE) 3D models, (ii) 3D/quasi-3D *continuum* models, (iii) *plate/shell* 2D models, for which first- or third-order shear deformation (or classical plate) theories are used, with either *global* (equivalent single layer) or *discrete* (layer-wise) kinematics. Literature analysis shows that neither of these approaches is satisfactory from the viewpoints of practicality (simplicity, time) and accuracy (vs. tests). On the other hands, hybrid honeycomb sandwiches are suitable for additional non-structural multi-functions, requiring sensors, actuators or transducers, that renders them smart when the latter are active. In this category, piezoelectric materials are the most used, but have to be selected carefully, with regards to the host sandwich-active patch interaction, in order to reach high effective electromechanical coupling. This PhD thesis aims to develop new approaches for FE-based characterizing, modelling and testing of smart hybrid honeycomb sandwiches with *piezoelectric macro-fiber composites* (MFC) for aeronautic and space constructions vibration-based applications. This includes, (i) a new *detailed FE modeling* approach of the smart piezo-composite (MFC) hybrid honeycomb sandwich; (ii) an original FE *homogenization* procedure for the whole hybrid sandwich (not only the honeycomb core); (iii) vibration-based mixed FE-experimental inverse *optimized identification* of the hybrid sandwich and MFC *behaviors* (not only their engineering constants). (iv) application of the developed numerical tools for either of shunted damping, sensing, actuation or energy harvesting as a smart hybrid sandwich construction application.
Mots clés	*Modelling*, *finite elements*, *homogenization*, *vibration-based behavior inverse optimized identification, hybrid honeycomb sandwiches, piezoelectric macro-fiber composites*, *effective electromechanical coupling, shunted damping, sensing, actuation, energy harvesting application*.
Profil et compétences du candidat	Target profile: *Master in Mechanics or similar* Expected competences: *finite element modeling*, *optimization (Excel solver, Matlab® toolboxes)*, Matlab® (m-files, GUI), Ansys® (APDL), *experimentation*.
Date de début de la thèse	Fall 2021
Lieu de travail de thèse	UT-Compiègne @ Roberval building (H, +1)

2e partie : Fiche de poste	
Durée	36 mois
Possibilité missions complémentaires	
Laboratoire d'accueil	Roberval (UT-Compiègne)
Moyens matériels	Office (individual or collective) + PC (Laptop) + internet (incl. VPN) Softs: Matlab®, Ansys®, MS Office® (Word®, PowerPoint®, Excel®) Equipments: vibration, (quasi-)statics, dynamics
Moyens humains	http://roberval.utc.fr/
Moyens financiers	
Modalités de travail	*Weekly meetings*, *monthly updates*, *under mutual request discussions*
Projet de recherche lié à cette thèse	
Collaboration(s) nationale(s)	
Collaboration(s) internationale(s	
Thèse en cotutelle internationale	No
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Contacter d'abord le directeur de thèse avant de renseigner
un dossier de candidature en ligne sur https://webapplis.utc.fr/admissions/doctorants/accueil.jsf