Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : SERRA   Given names : ROGER

Status (prof., assistant prof., …) : PROFESSOR

Laboratory : Laboratory of Mechanics (LaMé)   Website address : https://www.mechlabgabriellame.fr/

Institution : INSA CENTRE VAL DE LOIRE   Website address : www.insa-centrevaldeloire.fr

Scientific competence of the supervisor:

Dr SERRA Roger received his Master's degree in 1996 and his PhD degree in 1999 in mechanical engineering from Franche-Comte University, Besancon, France. Since 1999, he is Associate professor at INSA Centre Val de Loire at Blois, France and member of the Rheology and Mechanical Laboratory (LMR), Francois Rabelais University, Tours, France. In 2016, he becomes HDR. His research interests include mechanical vibration analysis and structural dynamics, experimental modal identification, condition monitoring of mechanical structures, machining vibrations, cutting tool wear monitoring, signal processing, vibratory fatigue and mechanical characterization.

Two major publications in the field proposed for the PhD :

1. Li X-L, SERRA R, Olivier J. A multi-component PSO algorithm with leader learning mechanism for structural damage detection, Applied Soft Computing, Volume 116, 2022, https://doi.org/10.1016/j.asoc.2021.108315

2. Li X-L, SERRA R, Olivier J. An Investigation of Particle Swarm Optimization Topologies in Structural Damage Detection. Appl. Sci. 2021; 11(11):5144. https://doi.org/10.3390/app11115144

Website address of the personal page : https://www.researchgate.net/profile/Roger_Serra

Supervisor's email : roger.serra@insa-cvl.fr

Description of the research work proposed for a PhD   **Topic # (see list) :** I-1/I-8/IV-12/VI-2

Title : Vibration based structural health monitoring by bio-inspired soft-computing approaches

Subject :

Structural damage detection based on vibration testing has received a lot of interest in recent years. Various methods (experimental and numerical methods, artificial intelligence techniques, wavelet analysis, classical indicators methods, ...) have been employed for the damage detection. But due to the large dimension of the structural identification problem, these approaches often get trapped in a local optimum and failed to obtain a reasonable solution. In this PhD, an investigation of bio-inspired soft computing methodology is proposed in order to increase the efficiency, accuracy and precocity of the structural monitoring. After a literature review of existing methods, the work will start with Particle Swarm Optimization and an original search space browsing strategy will be performed. In order to evaluate several parameter configurations and different fitness functions, parallel computing technics will be used and interactions/correlations analyzed. In the second time, a possible classification based on artificial intelligence and deep neural networks should be studied. The crack detection algorithms will be developed with Euler-Bernoulli beam simulated data and contrasted with others méthods. Finally, a validation on experimental beam measurements will be performed. The PhD student will be integrated in the research team with many international PhD students and two CSC PhD students.

Keywords :

structural health monitoring; vibration; frequency; mode shape; modal analysis; damage detection; soft computing; optimization methods; Particle Swarm; Neural networks, Machine learning

Expected collaborations :

The objective of this project is to initiate collaborations with Chinese or international researchers working on related topic in order to develop and share the knowledge on this topic. The PhD student will be co-supervised by an associate professor from the computer science laboratory (LI - EA 6300). The local team will bring skills with non-european students for many years and will ensure a blooming of the phD student with extracurricular activities like cultural and sport (golf, skiing week, ...). Blois is a little but marvelous historical city in the UNESCO Loire Valley.

Background required from the applicant :

After a top Master graduation in mechanical engineering where the applicant developed excellent skills on mathematics, programing, engineering science, computational methods, finite element and statistical concepts, i am looking for an applicant which has a goal to excel and live up the expectations in performing the project assigned. The applicant should have a great motivation about the field of the thesis and a strong determination to push down scientific limits. The co-supervisors will help the applicant to start his scientific career on this relevant topic.

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

(see guidelines on the website www-csc.utt.fr)