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 :	Mencik	Given names :	Jean-Mathieu
Status (prof., assistant prof., …) :	Professor		
Laboratory :	Laboratoire de Mécanique Gabriel Lamé	Website address :	https://www.mechlabgabriellame.fr/
Institution :	INSA Centre Val de Loire	Website address :	http://www.insa-centrevaldeloire.fr/

Scientific competence of the supervisor:

The research field of the supervisor covers: structural vibration, model reduction and periodic structures. He is a well-recognized international expert in these fields and possesses strong skills in the dynamic analysis of periodic structures. He published about 30 research articles on this topic and initiated strong partnerships with several national and international institutions (Ecole des Ponts ParisTech in France, University of Campinas in Brazil, Saõ Paulo State University in Brazil, among others).

Two major publications in the field proposed for the PhD :

1. J.-M. Mencik, “Improved model reduction with basis enrichment for dynamic analysis of nearly periodic structures including substructures with geometric changes”, Journal of Computational and Applied
2. J.-M. Mencik, “Model reduction based on matrix interpolation and distorted finite element meshes for dynamic analysis of 2D nearly periodic structures”, Finite Elements in Analysis and Design, 188, 2021, 103518.

Website address of the personal page : https://www.mechlabgabriellame.fr/annuaire/?id=260

Supervisor's email : jean-mathieu.mencik@insa-cvl.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-6

Title : Parametric model order reduction for dynamic analysis and optimal design of nearly periodic structures

Subject :

Nearly periodic structures can be seen as periodic structures that include cells with small parametric variations. These cells can represent any 2D or 3D substructures subject to geometric changes (mesh morphing) that may concern, for instance, bladed disks composed of sectors of different shapes (mistuning), or metamaterial plates including different resonant cells. When properly designed, such nearly periodic structures can reveal interesting properties like energy localization effect, wave beaming, robustness... Geometric changes of the cells can be understood as geometric variability or disorder. The key idea here is to seek the appropriate "levels of disorder" of the cells to optimize the properties of nearly periodic structures. Hence, geometric changes of the cells could be governed by random variables of different dispersions, i.e., randomness which is likely to vary between the cells. To carry out optimization procedures at affordable computational times, a parametric model reduction approach developed by the supervisor of the PhD proposal will be used. Then this PhD intends to develop original optimization procedures for the design of nearly periodic structures. In this framework, data driven approaches (e.g., physics informed neural networks) could be investigated to help develop the reduced models of nearly periodic structures and conduct the optimization procedures.

Keywords :

Nearly periodic structures, geometric changes, parametric model order reduction.

Expected collaborations :

France (University of Besançon); Brazil (University of Campinas, University of São Paulo); USA (University of Michigan)

Background required from the applicant :

Master in mechanical engineering with strong skills in structural vibration and numerical modeling (finite elements).

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

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