Séminaire du Pr. Sami EL-BORGI

College of Science and Engineering

Hamad Bin Khalifa University, Education City, Doha, Qatar

Mardi 23 septembre à 14h00

LEM3 – Campus Polytech Nancy – salle A-208

Vibration attenuation using locally resonant multiple bandgap formation

Abstract

This seminar presents first a strategy of vibration attenuation of a beam when multiple resonant frequencies of the structure are excited. The mechanism of multiple bandgap formation is presented by first deriving the equations of motion of the meta-structure based on Hamilton's principle and then utilizing a modal analysis approach to obtain analytical expressions for the edge frequencies of the created bandgaps. These edge frequencies are derived by assuming an infinite number of resonators tuned to different resonant frequencies of the beam at which a bandgap is desired to be centered at. Parametric studies on the steady-state dynamic response of the beam, however, reveal that only a finite number of resonators is required to create these bandgaps and that their bandwidths largely depend on the ratio of the mass of the resonators to that of the beam.

This second part of this seminar presents the application of tuned local resonators distributed along the length of a piping system to demonstrate vibration attenuation at its resonant frequencies. An experimental laboratory scaled version of a prototype piping system inspired from existing piping structures in the oil and gas industry is assembled to study its dynamic behavior under laboratory conditions. Discrepancies between measured and computed results due to uncertainties in the Finite Element (FE) model required the use of an FE model updating technique to minimize the error between the predicted and the measured response.

Biography of Professor Sami El-Borgi: Dr. Sami El-Borgi is a professor of Mechanical Engineering University in the College of Science and Engineering at Hamad Bin Khalifa University, Education City, Doha, Qatar. He was previously a professor at Texas A&M University at Qatar's Mechanical Engineering program from 2012 until July 2024 and at the University of Carthage, Tunisia from September 1994 until August 2012. He received his Ph.D. degree from Cornell University (Ithaca, New York, USA) in the field of structural engineering and applied mechanics in 1992. His master's degree was in the same field from Northwestern University (Evanston, Illinois, USA) in 1987. His bachelor's degree was obtained in civil engineering from Ohio State University (Columbus, Ohio, USA) in 1985. His field of research spans areas of metamaterials, structural health monitoring, continuum mechanics, fracture and contact mechanics, nonlinear vibration and smart manufacturing. He has published to date around 123 papers in high-impact journals in addition to one US patent. Over the last two decades, he has collaborated with well-known and reputable scholars in the fields of nonlinear vibration, fracture mechanics, contact mechanics and finite element analysis. Prof. El-Borgi has been awarded numerous research grants with funding provided by the Tunisian Ministry of Higher Education, Qatar National Research Fund, U.S. National Science Foundation, U.S. State Department, and the European Commission. In addition, he established in 2003 in collaboration with Dr. Ali Nayfeh of Virginia Tech a Master's program in Computational Mechanics and a Ph.D. program in Applied Mechanics at Tunisia Polytechnic School, University of Carthage, Tunisia. He has also provided services as a reviewer to more than 70 international journals and has been a member of the editorial board of a few engineering journals. In recognition of his services to the higher education sector, the Republic of Tunisia awarded him the Presidential Order of Merit of Education in 2008.

Séminaire organisé dans le cadre du programme interdisciplinaire MAT-PULSE (*Materials and Physics @ Ultimate Scale: Nanotech for a sustainable digital world)*