L'Aquila (Italy), 02/07/2021

CALL FOR POSTDOCTORAL FELLOWSHIP

The Department of Civil, Construction-Architectural and Environmental Engineering (DICEAA) of University of L'Aquila (Italy) offers 1 postdoctoral position for research activity in

STRUCTURAL MECHANICS

Applicants must hold a PhD degree or an equivalent qualification. The research grant is awarded for one year (with possibility of renewal) and its yearly amount is € 24.000,00 gross.
The competition announcement is published from July 5th, 2021 at https://www.univaq.it/section.php?id=766.
The application must be submitted through the online form available at https://pica.cineca.it by **July 19th, 2021** at 11:59 p.m. (Central European Time).
Supervisor of the research project will be Prof. Angelo Luongo (https://www.scopus.com/authid/detail.uri?authorId=7006463172).
For more information and assistance for the submission process, please write an email to angelo.luongo@univaq.it.

DESCRIPTION OF THE RESEARCH PROJECT

Title: "Dynamics, Stability and passive Control of micro-structured beams"
Among the numerous factors that influence the behavior of a structure and involve its analysis, many of them are detected in the fields of Dynamics, Stability and Control.
Only some issues are here cited, limiting to those of interest to the present Research Project and concerning micro-structured beams. (a) In Dynamics and Stability: static instability (buckling) induced by dead forces; dynamic instability induced by the action of position and velocity-dependent forces (e.g. follower torques and forces, aerodynamic forces, etc…); (b) In the Control: the use of added devices, like the Tuned Mass Dampers (TMD) and Nonlinear Energy Sinks (NES), aiming to mitigate the dynamic response of the primary structure in the linear and nonlinear fields.
The study of all these phenomena requires the formulation of accurate models and methodological tools such as: generalized 1D beam models, perturbation, and numerical methods. This Research Project aims: (1) to analyze, through analytical and numerical models, the Statics, Dynamics, and the Stability of micro-structured beams in the presence of geometric and constitutive nonlinearities, and

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conservative/nonconservative actions; (2) to develop advanced strategies of passive control for vibrations mitigation.
The Project is organized into the following two Stages (ST). In ST-A the Statics, Dynamics, and the Stability of micro-structured beams will be analyzed. In ST-B the Control strategies for vibration mitigation will be designed. In what follows a synthetic description of the two stages is detailed.

ST-A Statics, Dynamics, and Stability of micro-structured beams
This stage will be focused on the modelling and analysis of micro-structured beams characterized by complex static and dynamic behaviors. The onset of static and dynamic bifurcations in presence of geometric and constitutive nonlinearities and conservative/non-conservative forces will be systematically studied, with specific interest in:

- Buckling analysis of micro-structured beams

  Buckling analysis of homogenized beam-like structures will be addressed. Local and global buckling instability conditions will be detected and related to the designed microstructure. The postcritical response will be also analyzed through analytical and numerical methods;
- Dynamics stability of micro-structured flying beams

  The mechanical formulation of micro-structured flying beams models will be addressed. These are one-dimensional, eventually unconstrained, beams subject to impulsive and non-conservative (positional and velocity-dependent) forces, due to the concurrent effects of prescribed initial velocity, propulsive action of jet and rocket engines, interaction with the surrounding fluid. The attention will be paid to the analysis of: (i) trajectories of the global motion and their stability, (ii) amplitude of the elastic oscillations and detection of bifurcation conditions, (iii) combined effect of structural damping and aerodynamic actions.

ST-B Control strategies
This stage will be devoted to the definition of strategies for vibration mitigation of the micro-structured beam, through the systematic and optimized use of passive control added devices. The goal of obtaining considerable dissipation and/or vibration absorption will be addressed on theoretical models, with the application of analytical and numerical tools on systems with embedded TMD and NES. The target will be the development of passive control strategies that integrate the knowledge developed in the last 40 years on TMD and NES. The aim is to design lumped devices possessing a linear or nonlinear behavior suitable for the mitigation of the response of the beam-like structures. Attention will be paid to the definition of design criteria for the positioning of the devices, and to the effects of linear and nonlinear damping on the post-critical behavior.

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