UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II

DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA
CORSO DI DOTTORATO DI RICERCA IN
INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

XXXVI CICLO

Il sottoscritto Prof. **Luciano Rosati** (Professore Ordinario) afferente al Dipartimento di Strutture per lôIngegneria e lôArchitettura (S.S.D. ICAR/08 - Scienza delle Costruzioni)

CHIEDE

di essere inserito tra i possibili tutor di studenti di dottorato per il XXXVI ciclo.

1. Curriculum sintetico del proponente (max 500 parole)

Education

- 1976 | First Certificate Diploma in English at the British Council in Naples.
- 1982 | B.S. and M.S. degree in Mechanical Engineering (with honours) at University of Naples Federico II.
- 1984 | B.S. and M.S. degree in Civil Engineering (with honours) at the University of Naples Federico II.
- 1985 | TOEFL Diploma in English (marks 570/700) at the American Study Center.
- 1989 | Ph.D. in Structural Mechanics at the University of Naples Federico II.
- 1990 | Appointed as a researcher in Structural Mechanics at the University of Naples Federico II.
- 1997 | Two-months NATO-CNR grant for research activity at the Imperial College in London.
- 1998 | Appointed as associate professor of Structural Mechanics at the University of Naples Federico II.
- 2001 | Appointed as full professor of Structural Mechanics at the University of Naples Federico II.

Affiliations

- Member of the Professional Institution of Engineers in Naples (since 1983).
- Past Member of the National Secretary of the scientific area ICAR/08 ñMechanics of Structuresò.
- Member of the Research Task Committee ñInstructions for the Design, Construction and Control of Static Strengthening by means of fiber-reinforced compositesò, hosted by C.N.R. (National Research Council).
- Member of the Regional Center of Competence ñAnalysis and monitoring of Environmental Riskò.
- Member of the Excellence National Center ñStructural composites for innovative applicationsò.
- Member of the italian branch of the Natural Society of Philosophy.
- Coordinator of the PhD programme in Structural, Geotechnical and Seismic Risk Engineering.
- Component of the National University Council (CUN) as representative of Full Professors in Civil Engineering and Architecture.

Teaching Experience

- 1989 - 1998 Teaching assistant in courses of ñStructural Mechanicsò.
- 1994 - 1998 Courses of ñMechanics of Solidsò, ñComputational Mechanicsò.
- 2001 - present: Courses of ñStructural Mechanicsò, ñComputational Mechanicsò and ñNonlinear Structural Mechanicsò.

More Recent Funded Research Projects (Principal Investigator)

- 2015 - Research project (RP) entitled ñ*Advanced mechanical modeling of new materials and structures for the solution of 2020 Horizon challenges*ò funded by MIUR. Value: ú 45.000.
- 2012 - RP entitled ñ*Models and algorithms for nonlinear structural analysis and validation of performance-based design rules*ò funded by MIUR. Value: ú 45.000.
- 2007 - RP entitled ñ*Numerical algorithms for nonlinear modelling of reinforced concrete structures*ò funded by MIUR. Value: ú 49.000.
- 2005 - RP entitled ñ*Setting of guidelines for the strengthening of reinforced concrete structures by means of composite materials*ò, funded by the Regione Campania (regional institution). Value: ú 15.000.
- 2004 - RP entitled ñ*Development of numerical algorithms and constitutive models for the analysis of fiber-reinforced composite laminates*ò, jointly funded by the ñItalian Ministry for Education, University and Researchò (MIUR) and the Spanish Ministry for Education and Science. Value: ú 11.000.
- 2001 - RP titled ñModelling and analysis of adhesively bonded structural jointsò, jointly funded by MIUR and the French ñMinistère des Affaires Etrangèresò (France Foreign Office) within the framework of the program óGalileoô. Value: ú 8.000.

2. Dottorandi dei quali il proponente è stato tutor nellôultimo triennio	
n. 3	1. Davide Pellecchia, XXXIV cycle, PON grant 2. Massimo Paradiso, XXXIII cycle, university grant 3. Daniele Masi, XXXI cycle, university grant

3. Titolo della ricerca proposta

Experimental study and mathematical modeling of hysteretic devices subjected to pulse excitations

4. Area tematica

Structural engineering

5. Sintesi del progetto di ricerca (max 500 parole. Stato dellôarte, obiettivi e breve programma previsto per le attività)

State of Art

Wire Rope Isolators (WRIs) are metal devices that are extensively employed in different fields, such as aerospace, civil, and mechanical applications, in order to protect mechanical systems and materials from shocks and vibrations.

During the last two years, the research group coordinated by Prof. L. Rosati, has performed some experimental tests on such metal devices (in collaboration with Prof. G. Serino and Eng. M. Spizzuoco) in order to study their hysteretic behavior due to harmonic and random vibrations. In addition, the research group has formulated novel phenomenological models capable of simulating the typical symmetric (asymmetric) hysteresis loops displayed by WRIs deforming along their transverse (axial) direction. To simplify the parameters identification procedure, that can be carried out on the basis of the experimental results, the research group has also developed a computer program denominated *ParIde* (*Parameter Identification*).

Main Goals

In line with the above-described activities, essentially carried out during the last two years, the novel goal of the proposed research project is the experimental characterization as well as the simulation of the nonlinear response displayed by WRIs when they are subjected to pulse excitations. Specifically, the main goals are:

1. the study of the experimental behavior characterizing WRIs when they are tested by applying pulse excitations along one of their three main directions: the two transverse directions, namely Roll and Shear directions, and the axial direction;
2. the calibration, to be performed by means of the computer program *ParIde*, and the validation of the already developed symmetric (asymmetric) hysteretic models to simulate the experimental response obtained for pulse forces applied along the WRIs transverse (axial) direction;
3. the development of a computationally efficient solution strategy for the nonlinear dynamic analysis of rigid blocks supported by WRIs and the investigation of WRIs effectiveness in applications typical of aerospace (e.g., flutter control), civil (e.g., shock protection of sensitive equipment in hospitals), and mechanical (e.g., shock protection of mechanical systems) engineering.

Short Activities Program

The study and research activities of the Ph.D. student will be carried out at the University of Naples Federico II, at the *Institut Supérieur de Mécanique de Paris* (*Supméca*), and at *Powerflex s.r.l.*

The research activity will have a twofold nature:

a) **experimental activity**, required to achieve goal 1;

b) **numerical simulation activity**, required to achieve goals 2 and 3.

Specifically, the study and research activities will last 36 months. During the first 6 months of the first year, the Ph.D. student will improve her/his own knowledge by attending courses and seminars, at the University of Naples Federico II, on topics regarding *nonlinear dynamics*, *vibration control*, *numerical methods*, and *hysteretic models*. In addition, in the same period, the Ph.D. student will start the mathematical modeling activity, required for the analytical formulation of novel hysteretic models. During the next 6 months of the first year, the Ph.D. student will conduct researches at **Powerflex s.r.l.**, where he/she will perform experimental tests required for the study of the hysteretic behavior displayed by WRIs when subjected to pulse forces of different nature.

During the first 6 months of the second year, the Ph.D. student will continue the study activity (by attending courses and seminars) and the mathematical modeling activity at Unina Federico II. Afterwards, in the next 6 months, he/she will continue the study and research activities at **Supméca**. In particular, the Ph.D. student will perform additional experimental tests on WRIs and will work on the calibration and validation of the hysteretic models developed during the previous research activities.

In the first six months of the third year, a novel and efficient computational strategy will be developed and employed to investigate the effectiveness of WRIs when employed in applications typical of aerospace, civil, and mechanical engineering. Finally, during the last six months, the student will work on the Ph.D. thesis and will attend international conferences to present the main research results.

The proposed short activities program is summarized in the following Table, where ñ**U**ò is used for the study and research activities conducted at Unina Federico II, ñ**F**ò is used for the activities carried out at Powerflex s.r.l., ñ**A**ò for the activities conducted at Supméca, whereas ñ**X**ò stands for activities that do not require to be carried out in a specific place.

Period (in months)	0-6	7-12	13-18	19-24	25-30	31-36
Research Activity						
1) experimental tests		**F**		**A**		
2) numerical simulations	**U**		**U**	**A**	**U**	
Other Activities						
1) short courses and seminars	**U**		**U**	**A**		
2) conferences						**X**
3) publications						**X**
4) thesis						**X**

6. Eventuali pubblicazioni del tutor sul tema di ricerca (max 10)

International Journal Papers (Scopus/Web of Science)

1. Vaiana N, Sessa S, **Rosati L** (2020) A generalized class of uniaxial rate-independent models for simulating asymmetric mechanical hysteresis phenomena. Submitted to *International Journal of Engineering Science*.

2. Sessa S, Vaiana N, Paradiso M, **Rosati L** (2020) An inverse identification strategy for the mechanical parameters of a phenomenological hysteretic constitutive model. *Mechanical Systems and Signal Processing* 139: 106622.

3. Vaiana N, Sessa S, Marmo F, **Rosati L** (2019) Nonlinear dynamic analysis of hysteretic mechanical systems by combining a novel rate-independent model and an explicit time integration method. *Nonlinear Dynamics* 98(4): 2879-2901.

4. Vaiana N, Sessa S, Marmo F, **Rosati L** (2019) An accurate and computationally efficient uniaxial phenomenological model for steel and fiber reinforced elastomeric bearings. *Composite Structures* 211: 196-212.

5. Vaiana N, Sessa S, Marmo F, **Rosati L** (2018) A class of uniaxial phenomenological models for simulating hysteretic phenomena in rate-independent mechanical systems and materials. *Nonlinear Dynamics* 93(3): 1647-1669.

Conference Papers (Scopus/Web of Science)

1. Vaiana N, Marmo F, Sessa S, **Rosati L** (2020) Modeling of the hysteretic behavior of wire rope isolators using a novel rate-independent model. *Nonlinear Dynamics of Structures, Systems and Devices. Proceedings of the First International Nonlinear Dynamics Conference* (*NODYCON 2019*) 1: 309-317. https://doi.org/10.1007/978-3-030-34713-0 31.

2. Vaiana N, Sessa S, Paradiso M, **Rosati L** (2019) Accurate and efficient modeling of the hysteretic behavior of sliding bearings. *Proceedings of the 7th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering* (*COMPDYN 2019*). https://doi.org/10.7712/120119.7304.19506.

3. Vaiana N, Sessa S, Paradiso M, Marmo F, **Rosati L** (2019) An efficient computational strategy for nonlinear time history analysis of seismically base-isolated structures. *Proceedings of the* XXIV *Congresso dell'Associazione Italiana di Meccanica Teorica e Applicata* (*AIMETA 2019*).

7. Eventuali progetti di ricerca finanziati in cui lôattività si inserisce

8. Eventuali fondi disponibili a supporto dellôattività del dottorando (escluso finanziamento borse)

9. Informazioni relative ad un periodo di ricerca allêstero (minimo tre mesi) previsto per il dottorando (*indicare Università/ente di ricerca e docente/ricercatore di riferimento* con indirizzo mail) (max 300 parole)

University

Institut Supérieur de Mécanique de Paris - Supméca

Equipe Vibro Acoustique et Structures (VAST), Laboratoire Quartz - EA 7393, Supméca ï ISMEP, France

Advisor

Jean-Luc DION, Full professor (jean-luc.dion@supmeca.fr)

Short Description

The **six-month** activity abroad, scheduled in the second semester of the second year of the Ph.D. program, will be carried out at the **Laboratoire Quartz** of the **Institut Supérieur de Mécanique de Paris - Supméca**, that is specialized in the analysis and modeling of complex mechanical systems. In particular, in such a laboratory, researchers are interested in the study of the static and dynamic behavior of mechanical systems and novel materials, and in solving vibro-acoustic and multi-physical problems.
The research activity conducted by the Ph.D. student, will consist in experimental tests on WRIs and in the calibration and validation of the mathematical models formulated during the prior period spent at Unina Federico II.
The research work will be coordinated by **Prof. Jean-Luc Dion**, Full Professor of Vibration Mechanics and Signal Theory, and by Eng. Stefania Lo Feudo, researcher at the **Laboratoire Quartz**.

10. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)

Firm

Powerflex s.r.l, Limatola (BN), via Campitiello 6, 82030, Italy.

Firm Advisor

Antonio Lagreca, Engineering Department Manager (a.lagreca@powerflex.it).

Short Description

The **six-month** activity in a firm, scheduled for the second semester of the first year of the Ph.D. program, will be carried out at **Powerflex s.r.l**, a firm owning a twenty years know-how on mechanical design, structural analysis, as well as on mechanical and environmental qualification. Powerflex s.r.l. operates in different fields, such as the aerospace, industrial, military, and the seismic ones.
The research activity conducted by the Ph.D. student will consist in the study of the experimental behavior of WRIs obtained for different types of pulse forces and for different load directions, namely Axial, Roll and Shear directions.
The research work will be coordinated by the firm and the university advisors who will help the Ph.D. student with the set-up of the experimental tests and the interpretation of tests results.

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Napoli, 13 Febbraio 2020 FIRMA

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica phd.dist@unina.it entro e non oltre **venerdì 14/02/2020**.