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

XXXVIII CICLO

Il sottoscritto prof. Antonio De Luca

(PO ■ PA □ RU □ RTD □) afferente al Dipartimento di Strutture per l'Ingegneria e l'Architettura (DI.ST.)

S.S.D. ICAR09 – Tecnica delle Costruzioni)

CHIEDE

di essere inserito nell'elenco dei tutor per il XXXVIII ciclo.

1. Curriculum del proponente (max 500 parole)

Antonio De Luca is Professor of Structural Engineering (Group ICAR/09) since 1991. He is author of about 300 scientific papers, with particular attention for masonry structures, steel structures seismic engineering, and seismic isolation of buildings.
In the field of Base Isolation System (BIS), he has coordinated important research projects (COSMES, Parnaso (1998), PRIN (2000/2001), PRIN (1997/1999), PRIN (1995/1996). Since 2005 he is the Coordinator of a Research unit for the ReLUIS DPC Projects and he has also Coorganized and CoEdited with Giorgio Serino the volume "Base isolation and seismic control of structures and infrastructures" at conclusion of Task 7 activities within the Reluis research project (2005/2008). His earliest publications on BIS date back to the end of 80's (De Luca, A. and Serino, G., 1988 - 1989). Nowadays, he is author of about 70 scientific papers on this subject. His expertise in this field is also proved by Protezione Sismica Ministero dell'Università e della Ricerca scientifica e tecnologica at (http://www.protezionesismica.unina.it/INDEX2.htm).
He has carried out also many professional projects. He has design several outstanding base isolated buildings, also including retrofit solutions. He has been awarded (i) the ACAI 2001 award for the "Centro Commerciale San Paolo" of which he designed Steel Structures; (ii) the Sisto Mastrodicasa award in 2007 for the design of restoration of the masonry building: Palazzo Scarpa in Naples; (iii) the AICAP 2009 award for the design of the Don Bosco Bridge at Arenaccia in Naples.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
n. 1	*Paola Sorrentino - XXXVI ciclo*

3. Titolo della ricerca proposta

Retrofit of existing R.C. frame buildings through "hybrid" strategy with seismic isolation at the base and stiffening in elevation

4. Area Tematica

Ingegneria Geotecnica □

Ingegneria Strutturale ■

Rischio Sismico □

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

Within the European countries, 80% of the buildings is over 30 years old, 40% was built before the 60's, with a third of buildings over 50 years old. Many of these existing structures are the results of a gravity-load design approach, prior to the introduction of seismic codes. In particular, in Italy, a whole seismic country, many the existing R.C buildings date back to 1950-60s: their potential deficits in seismic capacity can be related to common design practice of their time. This makes necessary a preliminary evaluation of their seismic vulnerability), later looking for the appropriate strategy for seismic upgrading, or better yet, retrofitting. For the seismic retrofit of existing structures, base isolation systems (BIS) have often been used, as confirmed also by their application to historical and strategic buildings.

The new research program involves the application of the "hybrid" strategy for the retrofit of existing R.C. buildings: mainly dating back to 1950-70s, they result from a gravity-load design approach. This kind of solution merges two conceptually opposite design approach, opting for base isolation system applied to an existing structure, previously stiffened ad hoc by using shear walls.

To this aim, different case studies will be analysed, with a special regard to a common trend in structural design before the introduction of seismic codes. In particular, they will be considered R.C. frame buildings, characterized by resisting frames only in transversal direction. This leads the structure to have a low seismic capacity longitudinally and a high lateral deformability.

Considering this kind of configuration, preliminary evaluations on seismic vulnerability of these existing buildings will underline potential deficits of these structures, originally designed without taking into account seismic actions. Seismic assessment at the current state will be evaluated through push-over analysis on 3D-models of the current structures, later proceeding to seismic vulnerability assessment in ADRS plane.

On the base of seismic vulnerability assessment of the case studies at the current state, the effectiveness of the "hybrid" design strategy for seismic retrofitting of existing R.C. buildings will be evaluated, also in comparison with ordinary applications of BIS, that opt to make a "cut" in correspondence of the isolation level, without modifying the upper structure. Evaluation will also concern the technical feasibility of the hybrid solution. In fact, this kind of intervention appears easy in practice, without causing any kind of functional or structural limitations for the existing building.

6. Pubblicazioni sul tema di ricerca

1) Brandonisio, G., Guidi, L.G., Camarda, G., Sorrentino, P., De Luca, A. (2022). "Hybrid strategy for the seismic retrofitting of existing buildings through Base Isolation System ". Proceedings of ANIDIS 2022.
2) Brandonisio, G., Guidi, L.G., Michelino, D., Sorrentino, P., De Luca, A. (2022). "Seismic retrofit of an existing important building of the 60's through a hybrid strategy" Proceedings of ANIDIS 2022.
3) De Luca, A., Guidi, L.G., Brandonisio, G., Ponzo, F.C., (2022). "Horizontal capacity of base isolation rubber devices under large vertical design stress, valued through full-scale tests". Soil Dynamics and Earthquake Engineering. Volume 159, August 2022, 107264. https://doi.org/10.1016/j.soildyn.2022.107264.
4) De Luca, A. and Guidi, L.G., *Base isolation issues in Italy: Integrated architectural and structural designs*, Soil Dynamics and Earthquake Engineering, Elsevier. Volume 130, March 2020, 105912. Received 23 September 2018, Revised 21 October 2019, Accepted 21 October 2019, Available online 18 November 2019. DOI: 10.1016/j.soildyn.2019.105912
5) De Luca, A. and Guidi, L.G., *State of art in the worldwide evolution of base isolation design*, Soil Dynamics and Earthquake Engineering, Elsevier. Volume 125, October 2019,

105722. Received 24 September 2018, Revised 6 June 2019, Accepted 11 June 2019, Available online 11 July 2019. DOI: 10.1016/j.soildyn.2019.105722.

6) Montuori, G.M., Mele, E., Marrazzo, G., Brandonisio, G. and De Luca, A., *Stability issues and pressure–shear interaction in elastomeric bearings: the primary role of the secondary shape factor,* (2016) Bulletin of Earthquake Engineering, 14 (2), pp. 569-597. DOI: 10.1007/s10518-015-9819-x
7) Imbimbo, M., De Luca, A., *F.E. stress analysis of rubber bearings under axial loads* (1998) Computers and Structures, 68 (1-3), pp. 31-39. DOI: 10.1016/S0045-7949(98)00038-8.
8) Cuomo, G., De Luca, A. and Mele, E., *Design aspects in seismic isolation: Application to retrofit churches*. International Journal of Architectural Heritage. Conservation, Analysis and Restoration. Volume 2, (2008). DOI: 10.1080/15583050802063741.
9) Palmieri, A, Ricciardelli, F., De Luca, A. and Muscolino, G., *State space formulation for linear viscoelastic dynamic systems with memory*. Journal of Engineering Mechanics, Volume 129, Issues 7, pp. 715 – 724, (2003).
10) De Luca, A., Mele, E., Molina, J., Verzelletti, G. and Pinto, A.V., *Base Isolation for retrofitting historic buildings: Evaluation of seismic performance through experimental investigation.* Earthquake Engineering and Structural Dynamics. Volume 30, Issue 8, pp. 1125 – 1145, (2001). DOI: 10.1080/15583050802063741.
11) De Luca, A., Faella, G., *Modelling of elastomeric devices in the dynamic linear and nonlinear range*. Proceedings of the US- Italy workshop on "Seismic protective systems for bridges", Columbia University, NY (1988).
12) De Luca, A., Mele, E., *Base Isolation and Energy Dissipation General Report,* Proceedings of the second international conference STESSA '97, behaviour of steel structures in seismic areas, pp. 683-699. Kyoto, Japan (1998).
13) De Luca, A., Reinhorn, A.M., Faella, G., Mele, E., Ramasco, R., *Design level and damage in base isolated steel structures*. Proceedings of the 10th ECEE, Vienna (1994).

7. Progetti di ricerca finanziati in cui l'attività si inserisce

L'attività di ricerca

DPC-ReLUIS 2019-2021 WP5: Interventi di rapida esecuzione a basso impatto ed integrati.

8. Fondi disponibili per eventuali assegni, borse di ricerca, ecc., per acquisto eventuale di attrezzature, missioni
DPC-ReLUIS 2019-2021 WP5: Interventi di rapida esecuzione a basso impatto ed integrati.

9. Informazioni relative ad un periodo di ricerca all'estero (minimo tre mesi) previsto per il dottorando (*indicare Università/ente di ricerca e docente/ricercatore di riferimento*) (max 300 parole)
The program provides for a period abroad, to value performance of BIS buildings and to look at new design trend in Japan. This period will be in collaboration with Prof. Nakashima.

10. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)
The program provides the collaboration with the construction company Brancaccio, with its headquarters in Naples.

Napoli, 20/07/2022 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 **mercoledì 20/07/2022**