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 sottoscritti prof.riGaetano Della Corte e Federico Guarracino

(PO □ PA X RU □ RTD □)afferenti al Dipartimento diStrutture per l'Ingegneria e l'Architettura

S.S.D. (*indicare codice e nome per esteso)* ICAR/09 Tecnica delle Costruzioni e ICAR/08 Scienza delle Costruzioni

CHIEDONO

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

1. Curriculum sintetico deiproponenti (max 500 parole)

Gaetano Della Corte was born on March 28, 1972. He got Bachelor and Master of Science Degrees in Civil/Structural Engineering at the University of Naples Federico II, where he also got a PhD in Structural Engineering in 2001. From 2002 through 2014, he was Assistant Professor, and he is currently Associate Professor in the Department of Structures for Engineering and Architecture at the University of Naples Federico II. He is author of more than 150 publications on Journals, Conference Proceedings and Books. The main topics of his research activity are: Steel structures, earthquake engineering, seismic upgrading/retrofitting of existing structures, structural fire engineering. The research has been carried out both theoretically and experimentally. He is active member or principal investigator of research project dealing with seismic risk assessment of steel structures and, seismic upgrading/retrofitting of existing structures.

Federico Guarracino holds a Master of Science Degree in Engineering and a Doctorate in Structural Engineering. He has been a Visiting Researcher at the Department of Civil and Municipal Engineering of the University College of London (UK) and at the Department of Mechanical Engineering of the University of Surrey (UK). He is currently an Associate Professor at the Department of Structures for Engineering and Architecture of the University of Naples "Federico II".
He has authored over one hundred papers on conference proceedings and peer reviewed journals and is coauthor of a textbook in structural mechanics. He has been on the

Scientific Committee of several international conferences and regularly acts as a referee for well reputed journals. He sits on the Editorial Board of several indexed International Journal.
His research is focused on problems in solid and structural mechanics. Structural stability, elasticity, plasticity and micromechanics are all relevant in his activity. His projects are funded both from government agencies and industries.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio

n. 2	*specificare tipologia di borsa: ateneo, pon, por, senza borsa, ecc.* Gaetano Cantisani, con borsa di ateneo (tutor: Della Corte) Maria Grazia Simonelli, con borsa di ateneo (tutor: Guarracino)

3. Titolo della ricerca proposta

Inelastic flexural-torsional buckling of shear links

4. Area tematica

Ingegneria Geotecnica □

Ingegneria Strutturale X

Rischio Sismico X

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

Shear links are short beam segments that are used to provide seismic resilience to both new steel structures and existing reinforced concrete structures (seismic upgrading or retrofitting). The links are designed to develop plastic deformations in shear, until a limiting shear deformation is reached. Currently, seismic design codes assume values of the limiting shear deformation obtained from experimental results on typical links of newly designed eccentrically braced frames. In such modern design concepts, the link ends are restrained against out-of-plane displacements to avoid premature flexural-torsional buckling. The codes also provide information on forces to consider for the design of the restraining elements. However, there is very limited information about the general validity of the provided rules (i.e., limiting value of the shear deformation, need for restraining link ends, design forces for the restraining members and connections).

From a theoretical and experimental standpoint, the torsional buckling of short elements in the elastic-plastic range is still object of debate. In fact, the torsional instability of a cruciform column is the most classical example of the "plastic buckling paradox".The paradox consists in the fact that the more physically sound flow theory of plasticity seems to lead to a significant overestimation of the critical stress, whilst the less rigorous deformation theory seems to provide much more accurate predictions. Only recently the problem has been examined from its roots and it has been shown how a very good agreement between the results from the flow theory of plasticity and other analytical and experimental results can be obtained.

Therefore, the proposed research aims at investigating the issue of flexural-torsional buckling of shear links, in terms that are more general and theoretically consistent than the currently adopted empirical approach. The study will mainly address the following specific issues: (i) effects of different end restraint conditions; (ii) effects of the level of required inelastic deformation; (iii) effects of axial forces eventually acting on the link; (iv) effects of the material properties (e.g., strain-hardening characteristics); (v) geometry of the link cross-section.

The research will be articulated into the following three steps, essentially corresponding to the three years of the PhD study:

1) Investigating and understanding the state-of-the-knowledge, mainly collecting and analysing the available experimental and numerical results on the shear link response.
2) Developing and implementing numerical finite-element models of shear links with varying characteristics, to be subsequently analysed under different monotonic and cyclic loading conditions.
3) Analysing the responses obtained through the FEM results and, developing design rules.

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

Della Corte G., D'Aniello M., Landolfo R. (2013). Analytical and numerical study of plastic overstrength of shear links. *Journal of Constructional Steel Research*, 82, 19-32.

Mazzolani F.M., Della Corte G., D'Aniello M. (2007). Experimental analysis of steel dissipative bracing systems for seismic upgrading. *Proceedings of the 9th International Conference "Modern building materials, structures and techniques"*, Vilnius, Lithuania, 16-18 May.

Della Corte G., D'Aniello M., Mazzolani F.M. (2009). Plastic shear overstrength of short links with axial restraints. *Proceedings of the Fifth International Specialty Conference on Behaviour of Steel Structures in Seismic Areas (STESSA 2009)*, Philadelphia, USA, 16-19 August 2009, pp. 953-958.

Della Corte G., D'Aniello M., Mazzolani F.M. (2008). Plastic shear overstrength of short links: the effects of axial restraints. *Proceedings of the 5th European Conference on Steel and Composite Structures (Eurosteel)*, Graz, Austria, 3-5 September.

Della Corte G., D'Aniello M., Mazzolani F.M. (2007). Inelastic response of shear links with axial restraints: numerical vs. analytical results. *Proceedings of the 5th International Conference on Advances in Steel Structures*, Singapore, 5-7 December.

Della Corte G., Mazzolani F.M. (2006). Full-scale tests of advanced seismic upgrading techniques for RC structures. *Proceedings of the Second fib Congress*, Naples, Italy, 5-8 June

2006, paper No. 0432.

R. Shamass, G. Alfano e F. Guarracino: "A numerical investigation into the plastic buckling paradox for circular cylindrical shells under axial compression", Engineering Structures, Vol.75, pp.429-447, 2014.

R. Shamass, G. Alfano e F. Guarracino: "An analytical insight into the buckling paradox for circular cylindrical shells under axial and lateral loading", Mathematical Problems in Engineering, Vol. 2015, Article number 514267, doi: 10.1155/2015/514267, pp. 1-11, 2015.

R. Shamass, G. Alfano e F. Guarracino: "An investigation into the plastic buckling paradox for circular cylindrical shells under non-proportional loading", Thin-Walled Structures, Vol. 95, Article number 4581, pp. 347-362, 2015.

R. Shamass, G. Alfano e F. Guarracino: "On Elastoplastic Buckling Analysis of Cylinders Under Nonproportional Loading by Differential Quadrature Method", Int J of Structural Stability and Dynamics, Vol 17, Issue 7, Article number 1750072, 2017.

F. Guarracino e M.G. Simonelli: "The torsional instability of a cruciform column in the plastic range: Analysis of an old conundrum", Thin-Walled Structures, Vol 113, pp. 273-286, 2017.

F. Guarracino e M.G. Simonelli: "Numerical Evaluation of Plastic Buckling of Short Cylinders Under Combined Loading", Int J of Structural Stability and Dynamics, Vol 18, Issue 6, Article number 1850081, 2018.

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

Reluis-DPC 2019-2021: WP5Miglioramento o adeguamento sismico di edifici esistenti tramite controventi eccentrici in acciaio.

8. Eventuali fondi disponibilia supporto dell'attività del dottorando (escluso finanziamento borse)
Reluis-DPC 2019-2021,oltre fondi residui ed eventuali convenzioni da stabilire.

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* con indirizzo mail) (max 300 parole)
The student will be given the possibility to spend a period of study and research at the *London South Bank University*.The duration of the stay will be decided during the PhD course, according to the progress of the work and to the agreements with the receiving Institution. In any case, the period will be not shorter than three months. During his/her stay at the London South Bank University, the student will interact with Prof. Rabee Shamass, who has gained a significant expertise in the field of buckling analysis of steel structures.

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

Napoli, 14/02/2020 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 **venerdì14/02/2020**.