



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. ANTONIO BILOTTA

(PO PA RU RTD) afferente al Dipartimento di _____

__Strutture per l'Ingegneria e l'Architettura _____

S.S.D. (*indicare codice e nome per esteso* __ICAR/09 - Tecnica 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)

Antonio Bilotta, PhD, is Assistant Professor of Structural Engineering at the University of Naples Federico II, Italy. His research interests include:

- Strengthening of existing reinforced concrete structures by application of fiber-reinforced composite materials: on this issue an extensive experimental programme was personally carried out and the contribution for a statistical procedure for the calibration of capacity models from experimental data was implemented, in accordance with the suggestions provided by Eurocode 0. The application of the procedure allowed formulating a proposal for updating the design formulas of the Instructions CNR-DT200/2004. The proposal was now in the updated standard CNR-DT200-R1/2013. Moreover, with reference to the adhesion of FRP bars applied according to the technique NSM (near surface mounted) an extensive experimental programme of bond tests has been performed in the framework of the research project EN-CORE (Marie Curie research training network) - fib TG 9.3 (international federation for structural concrete - task group 9.3).
- Effects of fire on concrete structures reinforced with FRP bars: on this issue the writer collaborated for an activity concerning the effects of high temperatures on the performance of concrete members reinforced with FRP bars continued in cooperation with the Research Institute for Infrastructure and Environment of the University of Edinburgh (BRE - Centre for Fire Safety Engineering) where the writer has been Visiting Researcher.
- Behaviour of intumescent paints for fire protection of steel structures: on this issue, he is performing theoretical and experimental activities to assess thermal properties of intumescent coatings, which are necessary for calculations with advanced methods.
- Composite steel and concrete structures: on this issue the writer is secretary of the Task Group 2.6 of the fib (fédération internationale du béton / the International Federation for Structural Concrete), which is aimed to contribute to an unified approach for the design of steel, concrete and composite members.
- Effects of earthquake on structures: this theme the writer carried out reconnaissance activities following the recent earthquakes in Italy since 2009, and numerical analyses for the assessment of



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vulnerability and the design of the strengthening of existing structures.

The writer is author of more than 100 publication (about 30 on international peer reviewed journal)
 The writer participated to several national (more than 10) and international (more than 20) conferences, generally as speaker.

The writer participated to several national (more than 20) and international research projects, among which: RELUIS DPC 2005-2008, SIMURAI, RELUIS DPC 2010-2013, RELUIS DPC 2014-2018, RELUIS DPC 2019-2021, METRICS, METROPOLIS, GRISIS, RiqualiFire, CoIn, CERN.

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

n. 4

specificare tipologia di borsa: ateneo, pon, por, senza borsa, ecc.

1. Dr. Romeo Tomeo

Argomento di ricerca: Vulnerabilità sismica ed interazione terreno struttura
 (dal 2013 al 2016 - Discussione della Tesi in maggio 2017)

in co-tutoraggio con Prof. Emidio Nigro – borsa di Ateneo

Titolo Tesi: Soil-structure interaction effects on the seismic behaviour of reinforced concrete structures

2. Dr. Donatella de Silva

Argomento di ricerca: Protettivi per strutture in acciaio

(dal 2014 al 2017 - Discussione della Tesi in gennaio 2018)

in co-tutoraggio con Prof. Emidio Nigro – borsa di Ateneo

Titolo Tesi: Experimental investigation and numerical simulations on steel elements protected with intumescent coating

3. Ing. Alberto Compagnone

Argomento di ricerca: Strutture resistenti al fuoco

(dal 2016 ad oggi - Discussione della Tesi prevista in primavera 2020)

in co-tutoraggio con Prof. Emidio Nigro – borsa di Ateneo

Titolo Tesi: Probabilistic approach for simplified verification methods of resistance of steel frames in fire

4. Ing. Giusiana Testa

Argomento di ricerca: Valutazione della sicurezza dei ponti esistenti

(dal 2019 ad oggi - Discussione della Tesi prevista nel 2023)

in co-tutoraggio con Prof. Iunio Iervolino – borsa di Ateneo



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3. Titolo della ricerca proposta

Artificial intelligence systems integrated into technologies for structural monitoring

4. Area tematica

Ingegneria Geotecnica

Ingegneria Strutturale

Rischio Sismico

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

The activity is in the framework of Smart, Secure and Inclusive Communities area which refers to technological solutions for the creation of innovative models integrated in the management of urban and metropolitan areas. Specifically, the project tends to increase the availability of embedded computing ICT technologies and sensors for the management of transport infrastructures through the use of innovative low-cost electronic technologies coupled with software for processing and presenting the data collected which make use of the use of artificial intelligence (AI). The main motivation behind the proposal is the evident difficulty of managing the infrastructures currently present on the national territory through an appropriate use of emerging digital technologies. On the one hand, there is the need to manage those infrastructures which, due to the increasingly massive level of urbanization, are subject to higher traffic demands than those for which they were designed, often nearing the end of the maximum nominal life for which the operation of the infrastructure itself was envisaged in the absence of extraordinary maintenance. On the other hand, there is a need to continue to guarantee the safety of those infrastructures that are often overlooked because they persist in areas where the current context sees deterioration increase due to lower economic and development resources.

In this context, the research project plans to identify the peculiarities necessary for the specific development of the aforementioned technologies for bridge structures (ICAR/09) in cooperation with experts in the measurement research field.

For the proposed research is expected: (i) study of existing literature, (ii) experimental verification in the laboratory, (iii) prototyping in the company, (iv) modeling at research facilities both in Italy and abroad, (v) validation of the developed technology.

The literature review (i) will be conducted at the University of Naples Federico II, also thanks to access the bibliographic resources supplied to CERN, a partner of the project, which is promoting the development of artificial intelligence (AI) systems in different fields of study.



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The laboratory experimentation (ii) will concern the sensors and will take advantage of the equipment present in the laboratories of Naples Federico II, in particular the equipment at the CESMA laboratory. These devices are normally used to develop new generation sensors characterized by a low manufacturing cost and by the possibility of being inserted in wireless transmission systems.

The prototyping (iii) of Officina Elettronica SPA srl of the sensors and the data management system to be used for the preparation of the decision-making system, based on Artificial Intelligence algorithms, will require the expertise of the company's workshops and laboratories. In particular, the company's experience in the field of design, construction, installation and maintenance of IT and telematic systems will be available, including the realization of the electronic equipment used and the related software.

The development of the methodology that involves the use of artificial intelligence (iv) will be carried out in the academic field. It will also be the subject of specific activities with the foreign partner, CERN. The latter has a recent but consolidated experience on AI systems, suitably trained, capable of reconstructing the traces of collisions between particles faster than possible with untrained measuring instruments.

The validation (v) will finally be carried out by the researchers of the proposing subject (Federico II) with the necessary logistical and technological support provided by the industrial partner (Officina Elettronica SPA srl) on structures identified among those that are frequently subject to structural evaluation in the field of activity order conducted by the Department of Structures of Federico II.

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

Beyond preliminary not published studies conducted on this issue during the last year (three MSc Thesis), the following publications are related to bridges or measurement with innovative technologies.

F. Ceroni, M. Pecce, A. **Bilotta**, E. Nigro (2014). Strain assessment for the design of NSM FRP systems for the strengthening of RC members. Construction and building materials

A. **Bilotta**, F. Ceroni, E. Nigro, M. Pecce, (2015). Efficiency of CFRP NSM strips and EBR plates for flexural strengthening of RC beams and loading pattern influence. Composite structures

Del Prete I., **Bilotta** A., Nigro E. (2015). Performances at high temperature of RC bridge decks strengthened with EBR-FRP. Composites Part b, Engineering

Bilotta, A., Ceroni, F., Lignola, G.P., Prota, A., (2017). Use of DIC technique for investigating the behaviour of FRCM materials for strengthening masonry elements. Composites Part b, Engineering



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

The preliminary activity mentioned in the previous point is partially carried out within the project POR GRISIS - CUPB63D18000280007

8. Eventuali fondi disponibili a supporto dell'attività del dottorando (escluso finanziamento borse)

Possibility of economic support from the industrial partner for the prototyping.

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 research activity to be carried out abroad has the objective of acquiring specific skills in the implementation of artificial intelligence (AI) algorithms for the optimization of the monitoring process. The PhD student's stay will take place at the Geneva headquarters of CERN, which already collaborates with Naples Federico II for numerous projects on new generation techniques and measurement methods.

During his stay in Geneva, the PhD student will focus in particular on the implementation of training techniques (deep learning) on the basis of experimental data, in the absence of numerical and analytical models. Based on the results of the simulations, it will therefore be possible to gain confidence in the detailed design and in the operating schemes of the monitoring system, and in particular the arrangement of the measuring instruments on the structure which will be studied later, during the second part of the stay in the company .

In the following the details of the abroad institution:

CERN, European Organization for Nuclear Research - Geneva Switzerland, and host tutor Marco Buzio, Senior Scientist of the Technology Department (TE) marco.buzio@cern.ch.

Duration of stay: The stay at CERN will be 6 months, in the second year of activity

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

As described in the summary of the proposal the research activity can have the involvement of the industrial partner Officina Elettronica SPA S.r.l. The industrial tutor, in agreement with the academic supervisor, will take care of directing the student's activities and coordinating them with



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the company work plan. Periodic meetings will be organized, at least monthly, in which the PhD student will exhibit and discuss the progress of the research with the academic supervisor and the company tutor. Any corrections to the work program will be agreed upon between the parties in these meetings.

As concerns the duration of stay in the company, two periods of 6 months each are expected. The tentative schedule would foresee that two periods are preceded and followed by the initial (12 months) and final (6 months) phases in the University Department, interspersed with a 6-month period abroad.

Napoli, __14.02.2020__

FIRMA

A handwritten signature in dark ink, appearing to read 'Antonio Arlotta'.

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**.