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

XXXIX CICLO

Il sottoscritto prof. ANTONIO BILOTTA

(PO □ PA ■ RU □ RTD □) afferente al Dipartimento di Structures for Engineering and Architecture

S.S.D. (ICAR09 – Structural Engineering)

CHIEDE

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

1. Curriculum 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 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, RELUIS DPC 2022-2024.

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

n. _3___	*specificare tipologia di borsa: ateneo, pon, por, ecc.* 1. **Dr. Alberto Compagnone** Research topic: Fire resistant structures (from 2016 to 2019 - Thesis dissertation in March 2020) in co-tutoring with Prof. Emidio Nigro – university funds Thesis title: Probabilistic approach for simplified verification methods of resistance of steel frames in fire. 2. **Eng. Giusiana Testa** Research topic: Safety assessment of existing bridges (from 2019 to date - Thesis dissertation expected in 2023) in co-tutoring with Prof. Iunio Iervolino – university funds 3. **Arch. Ugo Carmando** Research topic: Application of artificial intelligence (AI) for structural monitoring systems for infrastructure (from 2020 to date - Thesis dissertation expected in 2024) funded by PON R&I 2014-2020 4. **Eng. Rosa Anna Nero** Research topic: Capacity of reinforced concrete joints (from 2022 to date - Thesis dissertation expected in 2026) funded by PNRR

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3. Titolo della ricerca proposta
Innovative approach for photogrammetric mapping of structures and automatic recognition of possible deterioration and damage.

4. Area tematica
Ingegneria Geotecnica □ Ingegneria Strutturale ■ Rischio Sismico □

5. Tipologia di borsa per la quale si propone il progetto
Ateneo □ DM 117 (Investimento 3.3) ■ Eagleproject S.p.A. *(in questo caso indicare l'azienda co-finanziatrice)* DM 118 (Investimento 4.1 P.A.) □ DM 118 (Investimento 4.1 generici) □ DM 118 (Investimento 4.1 Patrimonio culturale) □

6. Sintesi del progetto di ricerca (max 500 parole. Stato dell'arte, obiettivi e breve programma previsto per le attività e)
The collection of information about the maintenance status of bridges and buildings is generally performed via visual inspections. However, due to the limitation imposed by using human resources, a more efficient computer-based monitoring system allowing automatic detection of the damage level and its evolution through time would help in establishing a prioritization of intervention and selecting ad-hoc restoration schemes.

The activities are developed in the framework of the robot survey of bridges and buildings for automatic visual recognition of possible deterioration and damage.

Project Objectives:
This Ph.D. project aims to develop an innovative approach for photogrammetric mapping of bridges and automatic recognition of possible deterioration and damage using neural networks. The main objective is to conduct precise and detailed analysis on a large amount of surveys to analyse possible damage to the structure and improve the safety, maintenance, and management of infrastructure, also after a seismic event.

Planned activities:
1. Virtualization of viaducts and infrastructure using drone (photogrammetry) and laser scanner (mobile or static): Drones will be used to acquire high-resolution photogrammetric data and laser scanners, both mobile and static, to obtain an accurate three-dimensional representation of bridges and related structures. This will allow detailed digital models of the analyzed infrastructure to be created.
2. Three-dimensional data remodelling: Through the processing of the photogrammetric data and the data acquired with the laser scanners, accurate three-dimensional models of the bridges will be created. This stage will be crucial for subsequent analysis and training of neural networks.
3. Data analysis: A careful analysis of the acquired data will be carried out to identify and understand the structural properties of the bridges, including deterioration or pathologies.
4. Training of neural networks for automatic recognition of pathologies and deteriorations: Using neural networks, models will be trained for automatic recognition of pathologies and deteriorations present in bridges. This will allow a quick and accurate assessment of the condition of infrastructure, facilitating preventive maintenance and timely diagnosis of critical issues.
5. Development of a monitoring platform: a monitoring platform will be developed that will allow automatic recognition of pathologies and deteriorations on a large number of surveys. This platform will provide advanced tools for visualization, analysis, and reporting, to support decisions on maintenance and continuous monitoring of bridges.

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

Andrea Pollastro, Giusiana Testa, Roberto Prevete, Antonio Bilotta (2022). Variational Autoencoder and One-Class Support Vector Machine for unsupervised damage detection.

Proc. of the 14th fib International PhD Symposium in Civil Engineering Sep. 5 - 7, Rome, Italy.

Andrea Pollastro, Giusiana Testa, Antonio Bilotta, Roberto Prevete (submitted to IEEE TRANSACTIONS and JOURNALS) Semi-supervised detection of structural damage using Variational Autoencoder and a One-Class Support Vector Machine.

Alessandra De Angelis, Antonio Bilotta, Maria Rosaria Pecce, Andrea Pollastro, Roberto Prevete (submitted to Journal of Civil Structural Health Monitoring) Dynamic identification methods and artificial intelligence algorithms for damage detection of masonry infills.

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

- Reluis Ponti
- Reluis Acamir
- PON CADS

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

Possibility of economic support for experimental test from incoming research project on the topic.

10. 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 leader has good research collaboration outside Italy, most notably for this topic:

University of Edinburgh (UK), University of Madrid (Spain), University of Porto (Portugal), University of Thessaloniki (Greece).

11. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)
The research activity will be partially carried out at the Eagleproject S.p.A.

Napoli, 26/06/2023 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 **il 30/06/2023.**