

Research group

Structural and seismic safety of strategic and relevant existing constructions: buildings and bridges - SECURE

Reference year:

2024

Scientific Coordinator:

DE MATTEIS GIANFRANCO / Full Professor / Department of Architecture and Industrial Design (DADI) / Università degli Studi della Campania “Luigi Vanvitelli”

Group members:

GIANFRANCO DE MATTEIS – Full Professor
GIUSEPPE FAELLA – Full Professor
CLAUDIA CENNAMO – Associate Professor
GIORGIO FRUNZIO – Associate Professor
RICCARDO SERRAGLIO – Associate Professor
MARIATERESA GUADAGNUOLO – Assistant Professor (RTI)
MARINA D’APRILE – Assistant Professor (RTI)
CORRADO CHISARI – Assistant Professor (RTD-B)
DOMENICO IOVANE – Assistant Professor (RTD-B)
MATTIA ZIZI – Assistant Professor (RTD-A)
PASQUALE BENCIVENGA – Research Fellow
COSTANTINO DELL’AVERSANO – Research Fellow
Geol. EMANUELE VITTORIO IERVOLINO – Research Fellow
Arch. MARGHERITA CICALA - PhD
Ing. LUCIANA DI GENNARO – PhD Student
Arch. ROSINA IADEROSA – PhD Student
Arch. RICCARDO MIELE – PhD Student
Dott. ANGELA DIANA – PhD Student
Dott. FRANCESCO ROSELLI – PhD Student

Description of research lines:**1 – Structural and seismic safety of monumental buildings**

The research line deals with studies aimed at the seismic vulnerability assessment and protection of historical constructions. Through the identification of the prevailing historical-architectural and constructive characteristics, the main fragilities related to the behavior of structures are recognized. The developed methodology is aimed at: (i) planning territorial strategies for the mitigation of

seismic risk, capable of ensuring adequate performance levels of structures; (ii) experimenting by devices and intervention techniques (including the ones innovative and based on innovative technologies) capable of extending their residual life, in full respect of the architectural value of the assets considered

2- Structural and seismic safety of strategic and relevant buildings

The notable ancientness characterizing the existing Italian building heritage is generally one of the main causes, together with the absence of far-sighting handling policies in the last decades devoted to the protection and conservation, of the seismic vulnerability affecting the existing buildings. This peculiarity affects also strategic and relevant buildings. In this wide set of building typologies are included also hospitals and schools (according to regional laws enacted after OPCM n.3274 dated 20/03/2003). This research line is aimed at the mitigation of the seismic risk that is relevant for these structures also due to their significant exposure. In particular, the studies within this research line address the implementation of large-scale assessment methodologies to simulate damage scenarios for supporting the definition of intervention priority. This is developed in collaboration with competent authorities (e.g. ASL of Campania region and Ministry of Instructions), as well as actively participating in national research projects (Agreement DPC-ReLUIS 2022-24, WP4.6 Maps and seismic risk scenario of schools and hospitals).

3- Structural and seismic safety of existing road bridges

This research line focuses on the notable national problem of safeguarding the existing infrastructural heritage and in particular road bridges. With the recently enacted Italian “Guidelines for the classification, risk management, safety assessment and monitoring of existing bridges” (2022), unified multi-level procedures for the protection of such a constructional typology have been promoted. Such a procedure entails different detail levels: from the census of the structures to the accurate safety assessment of existing bridges. In this context, in collaboration with the FABRE Consortium and the Province of Caserta, the research group develops several activities supporting the main national handling bodies (e.g. ANAS Spa, Autostrade per l’Italia Spa) for the application of these procedures and the supervision of assessment and design activities. Moreover, this research line includes the different activities focused on the monitoring of existing bridges and the implementation of advanced survey methodologies for special structures (e.g. bridges with prestressed reinforced concrete elements with post-tensioned wires).

4- Structural and seismic safety of existing masonry arch bridges

A significant portion of the existing infrastructural asset consists of masonry arch bridges realized in the first decades of the last century on the basis of empirical criteria rather than rational and analytical approaches. The significant increase of vehicular traffic (both in terms of vehicles/day and weight of vehicles) subjects such in-service structures to work rates significantly higher than, in some cases, can lead to structural failure. This holds true also due to the fact that these centenary existing masonry arch bridges have overpassed their service life and thus are in critical conservation states. Moreover, as it is well-known, being these structures based on the static principle of the arch and realized with a no tensile resistant material (masonry), the occurrence of exceptional events (e.g. earthquake) can represent an even more significant hazard situation for their safety and operativity. Based on this, this research line focuses on the implementation of assessment and retrofitting methodologies for existing masonry arch bridges, also accounting for damaged and defective configurations. The studies developed within this research line include research aimed at implementing both assessment and retrofitting methodologies by means of integrated approaches

including the survey, the characterization, the numerical modelling and the proposal of sustainable and efficient structural enhancement solutions.

Relationships with other research groups of the University of Campania L. Vanvitelli during the last three years:

The members of the research group had (or still have) relationships with the following existing research groups of the Department of Architecture and Industrial Design:

- REST;
- StandardF-AU;
- Conoscenza, valorizzazione e comunicazione digitale dei patrimoni culturali;
- La forma dell'Architettura e del Design negli insediamenti, nel paesaggio e nello spazio interno;
- La Memoria dei Luoghi. Storia e valorizzazione del patrimonio architettonico e ambientale (MemoS);
- Efficienza Energetica ed Ambiente;
- Gemme e Gioielli: Storia e Design.

Participation in research projects during the last three years:

Title of the project: GESTIONE del rischio SISmico per la valorizzazione turistica dei centri storici dei Mezzogiorno – GENESIS (codice progetto ARS01_00883)

Principal Investigator: Prof. Enrico Spacone, Università degli Studi di Chieti-Pescara

Program title: Avviso del 13/07/2017 “Presentazione di progetti di ricerca industriale e sviluppo sperimentale nelle 12 aree di Specializzazione individuate dal PNR 2015-2020”

Description of the research project activities: The main objectives of the research concern the development of a computer platform for the collection of information on the historical-cultural heritage, aimed at the simulation of damage scenarios for the management of emergency situations (territorial scale); at the planning of interventions for the reduction of seismic risk (urban scale); at the development of structural behavior models for the evaluation of static safety and seismic vulnerability as well as the interventions that may be necessary according to the previous analysis (building scale).

Involved staff: Gianfranco De Matteis, Ornella Zerlenga; Giuseppe Faella; Sergio Sibilio; Danila Jacazzi; Giorgio Frunzio; Riccardo Serraglio; Marina D'aprile; Giovanni Ciampi; Mariateresa Guadagnuolo; Corrado Chisari; Vincenzo Cirillo; Mattia Zizi.

Partner institutions: Proposed by Università degli Studi G. D'Annunzio di Chieti.

Academic Partners: Università degli Studi della Campania Luigi Vanvitelli, Università degli Studi dell'Aquila, Università degli Studi della Basilicata, Università degli Studi Mediterranea di Reggio Calabria, Università degli Studi di Enna Kore, Università Iuav di Venezia, Università degli Studi di Bergamo, Università di Pisa

Industrial Partners: Tab Consulting S.r.l. TAB Consulting, Asdea S.r.l. ASDEA, Zugaro Guido & C. S.r.l., Target Euro S.r.l., Kibernetes S.r.l., FIP Industriale S.P.A., PRO.GE.77 S.r.l., SISIA S.r.l. SISIA, BOVIAR S.r.l., Consorzio C.i.p.a.e. A R.l., TELENIA S.r.l., Etna Hitech S.c.P.A., Fibre Net S.r.l.

State of the project: Positively evaluated/funded/ongoing

Submission date/Start/End of the project: 09-11-2017/01-01-2023/30-06-2025.

Title of the project: Evaluation of structural vulnerability and innovative intervention methods for

the protection of masonry historical constructions of Italian infrastructural heritage (CUP: B61B21005470007)

Principal Investigator: Prof. Gianfranco De Matteis

Program title: Programma Operativo Nazionale Ricerca e Innovazione 2014-2020

Description of the research project activities: The research activities deal with the development of methodologies for the structural vulnerability assessment of historical masonry constructions. In particular, the methodologies refer to infrastructural constructions (bridges) and address the problem following both a large-scale and a single-construction approach. The activities entail: i. the development of methodologies for the structural vulnerability assessment at a large scale; ii. vulnerability assessment methodologies by means of Finite Element Models; iii. the proposal of innovative, low-invasive and reversible retrofitting techniques.

Involved personnel: Mattia Zizi, Gianfranco De Matteis

Partner institutions: Fabre Consortium

State of the project: Positively evaluated/funded/ongoing

Starting/closing date: ---/01-01-2022/31-12-2024

Title of the project: Structural Assessment Framework of historical masonry towers and bridges to Enhance RESidual life – SAFE_RES

Scientific Coordinator: Prof. Gianfranco De Matteis

Program title: PRIN 2020

Description of the research project activities: The SAFE_RES project will develop a comprehensive strategy for the large-scale investigation, assessment and retrofitting of historical masonry towers and arch bridges to enhance their conservation and operativity by extending their residual life.

Involved personnel: Corrado Chisari, Giorgio Frunzio, Mariateresa Guadagnuolo, Pasquale Bencivenga, Jafar Rouhi.

Partner institutions: Politecnico of Milano, University of Udine, University of Catania, University of Padova

State of the project: not funded

Submission date: 01/2021

Title of the project: “Integrated PRocedure for assEssing and improVing the resiliENce of existing masonry bell Towers on a territorial scale” - PREVENT

Scientific Coordinator: Gianfranco De Matteis

Call title: VALERE 2019

Description of the research activities of the project: Enhancement and conservation of bell towers, with a multidisciplinary and multilevel approach, developed through three main research lines: Knowledge and survey (Zerlenga); Control and monitoring (Sibilio); Structural assessment and preservation (De Matteis). Such research lines develop independently but are strongly interconnected to each other. They converge in the fourth cross-cutting research line, which defines the main objective and result of the whole research, namely: Preservation and valorisation of exiting bell towers (All).

Involved Staff: Gianfranco De Matteis, Ornella Zerlenga, Sergio Sibilio, Corrado Chisari, Vincenzo Cirillo, Giovanni Ciampi, Daniela Cacace, Rosina Iaderosa, Giuseppina Iuliano, Mattia Zizi, Angelo Lavino, Yorgos Spanodimitriou, Riccardo Miele, Margherita Cicala

Partners: Intra-University project competition

Project status: Positively evaluated/funded/finished

Submission date/Start/End of the project: 13-02-2019/02-12-2019/02-12-2022

Title of the project: ARCH

Principal Investigator: Dott. Eng. Corrado Chisari

Call title: Programma per la Ricerca V:ALERE 2020 - Progetti di ricerca applicata e a carattere industriale per RTD di tipo A e B

Description of the research activities of the project: The ARCH project will explore a novel method for seismic retrofitting of arches and vaults in masonry structures through the use of innovative fibre-reinforced mortar with high ductility (ductile mortar). The ARCH project has the twofold aim of (i) increasing the bearing capacity of the structure, and (ii) maintaining the compatibility of the retrofitting strategy with the old materials present, overcoming the drawbacks of currently used techniques.

Involved Staff: Gianfranco De Matteis, Mattia Zizi, Pasquale Bencivenga

Partner institutions: ---

State of the project: Positively evaluated/funded/finished

Submission date/Start/End of the project: 12-03-2020/01-09-2020/31-12-2021

Title of the project: Seismic safety of historical and monumental masonry buildings: assessment methodologies and retrofitting techniques for the structural enhancement (Scholarship n°3 – DOT1349530, Project ID: B25D18000010006)

Scientific Coordinator: Prof. Gianfranco De Matteis

Call title: Nation-al Operational Program ESF-ESFR Research and Innovation (PON RI 2014-2020), Action I.1 related to Innovative Industrial Ph.D.

Description of the research activities of the project: The project aims at an in-depth knowledge of the behaviour of masonry structures, in order to propose adequate intervention criteria aimed at seismic improvement and retrofitting of the existing heritage, respecting the requirements of reversibility, cost-effectiveness and material compatibility.

Involved Staff: Mattia Zizi

Partners: UM, Università del Minho, Portugal, EDIL Cam® Sistemi Srl

Project status: Positively evaluated/funded/finished

Start/End of the project: 2018-2021

Title of the project: PON AIM (ID: AIM1879349-2)

Scientific Coordinator: Prof. Arch. Ornella Zerlenga

Call title: National Operational Program ESF-ESFR Research and Innovation (PON RI 2014-2020)

Description of the research activities of the project: Definition of re-functionalization, static-conservative and seismic improvement interventions, to be implemented on a large scale, based on effective sustainable and innovative techniques and technologies, which are able to guarantee adequate performance levels, respecting the historical and cultural value of the property.

Involved Staff: Gianfranco De Matteis, Corrado Chisari

Partners: -

Project status: Positively evaluated/funded/finished

Submission date/Start/End of the project: ---/22-07-2019/21-07-2022

Title of the project: Advanced procedures for SAFETy assessment of existing Masonry Arch Bridges – SAFE_MAB

Principal Investigator: Mattia Zizi

Call title: Bando di selezione per il finanziamento di progetti di ricerca fondamentale ed applicata dedicato ai giovani ricercatori

Description of the research activities of the project: The SAFE_MAB project will focus on existing Masonry Arch Bridges (MABs) by means of a multidisciplinary approach involving the scientific disciplines of Structural Engineering (ICAR/09), Structural Mechanics (ICAR/08) and Drawing (ICAR/17). The main aims of the SAFE_MAB project proposal are to identify the defects mostly influencing the capacity in facing external loads of MABs and to propose innovative methodologies for their survey.

Involved Staff: Mariateresa Guadagnuolo (CO-PI), Giorgio Frunzio, Corrado Chisari, Pasquale Bencivenga, Luciana Di Gennaro

Partner institutions: ---

State of the project: Positively evaluated/funded/finished

Submission date/Start/End of the project: 08-07-2022/03-10-2022/02-01-2024

Project title: Shape and sTStructure in mAsonry staiRcasES in Naples. Criteria for the definition of knowledge models for safeguard and local tradition enhancement (STARES)

Scientific coordinator: Vincenzo Cirillo

Call title: Call for proposal for the funding of fundamental and applied research projects dedicated to young researchers.

Descrizione delle attività di ricerca: STARES will investigate masonry staircases using interdisciplinary criteria, techniques, and tools for the preparation of knowledge models useful for critical analysis, recovery, and enhancement of the asset.

The most recent European provisions on cultural heritage enhancement are giving main importance to (i) the safeguarding of the places identity values, (ii) the recovery of local traditions and, (iii) the virtualization of contexts and inclusive use. Within this context, STARES will focus on the masonry staircases of the Neapolitan 18th century located in residential palaces and based on renowned models designed by the architect Fernando Sanfelice: a built heritage of immense architectural and cultural value, which also contains a construction tradition to be known and recovered to safeguard it. Nowadays, natural, and anthropic actions, degradation phenomena, denaturalization of the original design (for example, by insertion of additional stiff elements such as elevators inside the wells or on the façade) and, above all, the insufficient awareness of the original construction technique, constitute worrying factors that contribute to the risk of losing this architectural and constructive heritage. It is thus imperative to increase knowledge of these assets, aiming at designing suitable protection actions and enhance their access by the community, which is the objective of STARES project.

Involved persons: Corrado Chisari (co-PI), Ornella Zerlenga, Margherita Cicala, Luigi Corniello, Francesco Roselli.

Status: Positively evaluated/funded/ongoing

Project start/end date: September 2023 - April 2024

Title of the project: DAMAGES

Principal Investigator: Dott. Eng. Paolo Zampieri (University of Padova)

Call title: PRIN 2022 PNRR

Description of the research activities of the project: DAMAGES project is aimed at advancing scientific knowledge in the assessment of existing masonry arch bridges subjected to exceptional environmental actions by: (i) improving comprehension of causes-effects processes that induce complex damage scenarios in masonry bridges; (ii) defining adequate constitutive models for the

description of the nonlinear behaviour of masonry material accounting for pre-existing degradation, which will include probabilistic approaches to consider the non-deterministic nature of the mechanical properties of the constituents and the uncertainty in the distribution/localization of damage; (iii) developing effective assessment strategies for damaged masonry bridges up to collapse to investigate the evolution of safety level.

Involved Staff: Corrado Chisari (Coordinator of the research unit), Roberto Serpieri

Partner institutions: University of Padova and University of Perugia

State of the project: submitted/not funded

Submission date: 30-11-2022.

Title of the project: High-performance materials for sustainable structures

Principal Investigator: Prof. Vincenzo Piluso (University of Salerno)

Call title: PRIN 2022

Description of the research activities of the project: The resistance of the material and the related structural performances is no more sufficient in performance evaluation, as soon as other issues need to be included, such as those related to sustainability. In this research project, the attention is focused on the performance evaluation of stainless steel and aluminium alloys including cradle-to-gate and gate-to-site environmental performances, structural performances in terms of exhibited ultimate resistance and ductility, the resulting greenhouse emissions of structures as affected by the required safety levels and the life-cycle behaviour as affected by the corrosion resistance.

Involved Staff: Gianfranco De Matteis (Coordinator of the research unit), Mariateresa Guadagnuolo

Partner institutions: University of Campania “Luigi Vanvitelli”, University of Padova, University of Catania

State of the project: submitted/not funded

Submission date/Start: 27-03-2022.

Title of the project: Structural Assessment and development of innovative saFEGuard Measures fOr hisTORical masONry towers_SAFEMOTION

Principal Investigator: Prof. Gianfranco De Matteis

Call title: PRIN 2022-PNRR

Description of the research activities of the project: SAFE_MOTION aims at developing innovative techniques and methods for investigation, assessment and retrofitting of historical masonry towers, in order to enhance their conservation, use, fruition and to extend their residual life. To reach the objective, complementary expertise of the research units will be provided, namely in the fields of dynamic monitoring, identification and damage assessment, numerical modelling, structure testing and retrofitting design.

Involved Staff: Giorgio Frunzio, Mariateresa Guadagnuolo Corrado Chisari, Mattia Zizi, Luciana Di Gennaro

Partner institutions: University of Padova, University of Udine

State of the project: Positively evaluated /funded/ongoing

Submission date: 30-11-2022/12-2023/11-2025

Title of the project: TRAILED-LAB: Un Laboratorio Mobile a Servizio dei Comuni del Cratere

Principal Investigator: Prof. Giuseppe Brando, University “G. d’Annunzio” of Chieti-Pescara

Call title: Avviso per la selezione di progetti di promozione della ricerca, del trasferimento tecnologico e della formazione universitaria da finanziare nelle regioni Lazio, Abruzzo, Umbria e

Marche interessate dagli eventi sismici del 2016

Description of the research activities of the project: “TRAILED-LAB” is a new research centre integrating mobile facilities for in-situ measurements of materials, structures and infrastructures, with fixed standard facilities. TRAILED-LAB aims at providing an advanced instrument for supporting reconstruction and decision-making processes, for both assessments of recovery interventions for seismically damaged buildings and infrastructures and addressing the choices on the re-use of construction materials of collapsed buildings.

Involved Staff: : Gianfranco De Matteis, Giorgio Frunzio, Corrado Chisari, Mariateresa Guadagnuolo, Mattia Zizi

Partner institutions: University “G. d’Annunzio” of Chieti-Pescara, University of Camerino, National Institute of Geophysics and Vulcanology -INGV

State of the project: funded

Submission date: 25-02-2022.

Title of the project: WRENCH - Whispers of Time: Heritage as Narratives of Climate-Change

Principal Investigator: Prof. Marco Armiero (Autonomous University of Barcelona)

Call title: Collaborative Research Action (CRA) - Climate & Cultural Heritage (CCH) 2023

Description of the research activities of the project: WRENCH aims to address the effects of climate change on tangible and intangible heritage, while broadening the understanding of heritage to include narratives, narratives, and ephemeral legacies. WRENCH envisions cultural heritage as both something at risk and something that can tell a story about the risk we are all taking.

WRENCH has the dual objective of (a) developing a transdisciplinary methodology involving environmental sciences, engineering and humanities to investigate the impact of climate change on tangible and intangible heritage; (b) use heritage as a storytelling tool to improve awareness of climate change.

Involved Staff: Corrado Chisari (Responsible of Research Unit), Gianfranco De Matteis, Michelangelo Scorpio, Sergio Sibilio

Partner institutions: Autonomous University of Barcelona (PI), Durham University, Orta Dogu Teknik Universitesi, Hidromod, Durham Castle, Diocesi di Ragusa - Chiesa Madre Duomo di San Giorgio, Consorzio “Coop4Art”

State of the project: approved

Submission date: 08-09-2023

Title of the project: “Green Ways. Wissensrouten und Netzwerke zwischen Orten mit besonderen regionalen, historischen und kulturellen Prägungen” [Green Ways. Percorsi di conoscenza e reti ecosostenibili tra luoghi dal particolare valore storico e culturali]

Principal Investigator: Prof. Karin Lehmann (Università delle Scienze Applicate di Bochum)

Call title: Dialogue with South Europe 2021 / Hochschuldialog mit Südeuropa 2021 (Dialogo universitario con il Sud Europa)

Description of the research activities of the project: Based on the proven German experiences in the fields of green economy and sustainable tourism and accounting for the recent COVID-19 pandemic event, the research focuses on the study of historic-architectonic itineraries for “knowledge paths” able to enhance the recognition and fruition of the “memory of places”, triggering virtuous mechanisms of revaluation of local economies.

Involved Staff: Marina D’Aprile

Partner institutions: ---

State of the project: Positively evaluated/funded/ongoing

Submission date/Start/End of the project: ---/01-01-2021/31-12-2022.

Title of the project: Il patrimonio storico degli spazi della salute in Campania: un modello per il recupero e la valorizzazione ecologica e inclusiva dei beni culturali a funzione assistenziale

Principal Investigator: Prof. Fabio Mangone (Università Federico II di Napoli)

Call title: PRIN 2022

Description of the research activities of the project: The research aims to study in a multidisciplinary, multiscale and multisectoral key, the historical structures for care, assistance and hospitality with continuity of function. The objective is to define specific operational protocols for the recovery, reuse and enhancement, able to condense the right to the architectural heritage with that to health and hospitality, taking into account the modalities of hospitalization, summarize the continuity of role with the preservation of architectural and artistic values, in a current cultural, regulatory, performance, ecological and inclusive.

Involved Staff: Marina D'Aprile

Partner institutions: ---

State of the project: Positively evaluated

Submission date: 27-03-2022.

Title of the project: Thermal Heritage for Ecosustainable Regeneration, Mobility and Economy

Principal Investigator: Dott. Monica Esposito

Call title: Bando di selezione per il finanziamento di progetti di ricerca fondamentale ed applicata dedicato ai giovani ricercatori

Description of the research activities of the project: The research aims to define a strategy of valorization of the anthropized territories of Campania, in particular those characterized by degradation and prolonged abandonment, through the integrated and compatible reuse of natural and cultural resources.

Starting from the history of the territory, together with the analysis of its socio-economic and cultural characteristics and its material and intangible values, the thermal system of Campania will be studied as a possible engine of future policies to enhance the territory, with a view to sustainable development.

Involved Staff: Marina D'Aprile, Riccardo Serraglio

Partner institutions: -

State of the project: Positively evaluated/funded/ongoing

Submission date/Start/End of the project: 08-07-2022/10-2022/01-2024

Project title: Inaccessible religious architecture. A workflow of knowledge, 'expanded' usability and 'inclusive' accessibility (EX-IN_AccessiBILITY)

Principal Investigator: Vincenzo Cirillo

Call title: PRIN 2022

Description of the research activities of the project: The project proposes to investigate the religious architectural heritage of the city of Naples (Italy) to transform the condition of inaccessibility of some assets into a renewed accessibility, with the preparation of 'expanded' fruition systems (physical and virtual) capable of enhancing the user experience with multi-sensory input design. Through the definition of a theoretical framework of taxonomy of the inaccessibility of the investigated context, the project will identify scenarios that re-insert religious architectures in the circle of possible experiences in situ, determining a virtuous effect on the local economy and on the regeneration of the contexts of membership. In particular, the expected result is the encoding of

a

operational workflow for 'inclusive' accessibility and 'expanded' usability of religious architecture even during the implementation of safety measures (provisional works).

Among the impacts of the research, there is the possibility of adopting the operational workflow for other classes of cultural heritage for the acquisition of future funding for enhancement interventions.

Involved staff: Ornella Zerlenga

Status: funded

Submission date: 03-2022

Project title: Dottorati di Ricerca Innovativi a caratterizzazione industriale, Architettura Disegno Industriale Beni Culturali (codice DOT1349530)

Scientific coordinator: Ornella ZERLENGA

Call title: Dottorati di Ricerca Innovativi a caratterizzazione industriale, Architettura Disegno Industriale Beni Culturali

Description of the research activities of the project: technologies and applications for the conservation, management and enhancement of cultural heritage.

Involved staff: Ornella Zerlenga

Partner institutions: University of Cartagena, Spain

Status: positively evaluated / funded / ongoing

Project submission/start/end date: ---/2020/2023

Scientific products of the last three years:

Scientific publications on Class A journals and/or indexed in the Scopus/WoS databases:

- [1] Zizi, M., Bencivenga, P., & De Matteis, G. (2023). Handling policies for Italian existing bridges with a territorial approach: the case study of Caserta, Italy. *Structures*, 48, 1306–1321. <https://doi.org/10.1016/J.ISTRUC.2022.12.114>
- [2] Zizi, M., Chisari, C., Rouhi, J., & De Matteis, G. (2022). Comparative analysis on macroscale material models for the prediction of masonry in-plane behavior. *Bulletin of Earthquake Engineering*, 20(2), 963–996. <https://doi.org/10.1007/s10518-021-01275-x>
- [3] Chisari, C., Cacace, D., & De Matteis, G. (2022). A mechanics-based model for simplified seismic vulnerability assessment of masonry bell towers. *Engineering Structures*, 270. <https://doi.org/10.1016/j.engstruct.2022.114876>
- [4] Guadagnuolo M., Aurilio M., Nuzzo M., Faella G., (2023). Historic chimney stacks: seismic assessment and kinematic analysis, *Journal of Architectural Engineering*, ASCE. [doi.org/10.1061/\(ASCE\)AE.1943-5568.0000571](https://doi.org/10.1061/(ASCE)AE.1943-5568.0000571).
- [5] Di Gennaro L, Guadagnuolo M, Monaco M., (2023). Rocking Analysis of Towers Subjected to Horizontal Forces. *Buildings*, 13(3):762, <https://doi.org/10.3390/buildings13030762>
- [6] Chisari, C., Cacace, D., & De Matteis, G. (2022). A mechanics-based model for simplified seismic vulnerability assessment of masonry bell towers. *Engineering Structures*, 270. <https://doi.org/10.1016/j.engstruct.2022.114876>
- [7] Pantò, B., Chisari, C., Macorini, L., & Izzuddin, B. A. (2022). A hybrid macro-modelling strategy with multi-objective calibration for accurate simulation of multi-ring masonry arches and bridges. *Computers & Structures*, 265, 106769. <https://doi.org/10.1016/J.COMPSTRUC.2022.106769>
- [8] Simoncello, N., Zampieri, P., Zizi, M., Rossi, L., & Pellegrino, C. (2022). Lateral response of



damaged stand-alone arches: Tilting tests and rigid-block analysis. *Engineering Structures*, 268, 114700. <https://doi.org/10.1016/J.ENGSTRUCT.2022.114700>

- [9] Massaro, L.; Di Gennaro, L.; Guadagnuolo, M.; Frunzio, G. (2023) Strengthening of masonry arches: The "Santa Maria delle Grazie" Church, *COMPdyn Proceedings, 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering*, Athens, Greece, 12-14 June 2023.
- [10] Cennamo, C., Cusano, C., Cutolo, A., Guarracino, F. & Mascolo, I. (2023) The dome of the San Francesco di Paola basil: a real geometry based assessment. *COMPdyn Proceedings, 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering*, Athens, Greece, 12-14 June 2023.

Additional 10 scientific products:

- [11] Chisari, C., Zizi, M., Rouhi, J., Lavino, A. & De Matteis, G. (2022). Ambient Vibration Testing and model updating of the bell tower of St. Michele Arcangelo Cathedral in Casertavecchia, Italy. In *Proceedings of XIX ANIDIS Conference, Seismic Engineering in Italy*. 11-15 September 2022, Torino, Italy
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Relationships with international and national Companies, Institutions, Research Centers, Universities during the last three years:

- The research work is linked with the research activities connected with the ReLUIIS project DPC 2019-2021, concerning: WP2 (Inventory of existing structural and building types - CARTIS); WP4 (Risk maps and seismic damage scenarios - MARS); WP12 (Regulatory relating to civil and industrial steel construction). Lead scientist: Prof. Gianfranco De Matteis
- Fabre Consortium "Research consortium for evaluation and monitoring of bridges, viaducts and other structures" for scientific and research activities related to the survey and assessment of existing road bridges. Lead scientist: Prof. Gianfranco De Matteis
- Autostrade per l'Italia S.p.A., for collaboration and research activities in the field of infrastructural engineering related to highway network handled by ASPI. Lead scientist: Prof. Gianfranco De Matteis.
- Dioceses of Sessa Aurunca, for scientific support in the definition of structural aspects aimed to the realization of the new bell tower of the Santi Pietro e Paolo Cathedral in Sessa Aurunca. Lead scientist: Prof. Gianfranco De Matteis.
- Istituto Nazionale Tumori IRCCS – Fondazione Pascale, for support, coordination, supervision and review of seismic vulnerability assessment of buildings of handled buildings. Lead scientist: Prof. Gianfranco De Matteis.
- Azienda Ospedaliera di Rilievo Nazionale Sant'Anna e San Sebastiano of Caserta, for support, coordination, supervision and review of seismic vulnerability assessment of buildings of handled buildings. Lead scientist: Prof. Gianfranco De Matteis.
- Azienda Ospedaliera "Ospedali Dei Colli", for support, coordination, supervision and review of seismic vulnerability assessment of buildings of handled buildings. Lead scientist: Prof. Gianfranco De Matteis.
- Azienda Ospedaliera dell'Università degli Studi della Campania "Luigi Vanvitelli", for support, coordination and supervision and review of activities aimed to seismic and structural safety of handled buildings. Lead scientist: Prof. Gianfranco De Matteis.
- Agreement for research activities: Department of Civil Engineering, University of Salerno [Delibera del C.di Dip. n. 13 del 17/12/2020]. Lead scientist: Dott. Eng. Corrado Chisari
- Agreement for research activities with "Laboratorio TecnoLab srl - Construction Materials Testing Laboratory" in Naples. Lead scientist: Dott. Arch. Mariateresa Guadagnuolo
- London Metropolitan University: Dott. Arch. Marina D'Aprile.
- CREATURE – Research Centre in Creative Arts, Culture and Engagement: Dott. Arch. Marina D'Aprile.
- Valletta Higher Education Institute: Dott. Arch. Marina D'Aprile.
- Comune di Mercato San Severino (SA): Dott. Arch. Marina D'Aprile.
- Universidad de Alcalá Facultad, Escuela Técnica Superior de Arquitectura. Departamento de Arquitectura, Alcalá de Henares (Spain): Prof.ssa Arch. Ornella Zerlenga.
- Universidad Politécnica de Cartagena, Escuela Técnica Superior de Arquitectura y Edificación:

Prof. Arch. Ornella Zerlenga.

- Universidade de Lisboa, Faculdade de Arquitectura. Departamento de Artes, Humanidades e Ciências Sociais, Lisboa (Portugal): Prof. Arch. Ornella Zerlenga.
- Universitat de les Illes Balears (UIB), Higher Polytechnic School (Spagna): Prof. Arch. Ornella Zerlenga.
- University of Applied Sciences, Hochschule Koblenz (Germania): Prof. Arch. Ornella Zerlenga.

Collaborations with Consortia, Scarl or other Institutions participated by the University of Campania L. Vanvitelli during the last three years:

- Consortium FABRE “Research Consortium for assessment and monitoring of bridges, viaducts and other structures.” (Consortium members: ENEA, University of Camerino; University of Campania “Luigi Vanvitelli”; University of Messina; University of Padova; University of Perugia; University of Pisa; Polytechnic of Milano; Polytechnic of Torino). Prof. Gianfranco De Matteis is Coordinator of the activities of the Consortium for the University of Campania “Luigi Vanvitelli”, Member of Consortium Scientific Committee and Member of the Consortium Executive Board.

ISI Web of Science Subject Categories:

- Engineering, Civil
- Engineering, Mechanical
- Material Science, Characterization & Testing
- Material Science, Composite
- Construction & Building Technology

Scientific-Disciplinary Sectors:

- ICAR/08
- ICAR/09
- ICAR/17
- ICAR/18
- ICAR/19

Keywords:

- Strategic Buildings
- Cultural Heritage
- Bridges
- Seismic Safety
- Structural Safety
- Masonry
- Reinforced Concrete
- Structural Enhancement
- Seismic Enhancement
- Retrofitting Technique

ERC Categories:

- PE8_3: Civil engineering, maritime/hydraulic engineering, geotechnics, waste treatment
- PE8_4: Computational engineering
- PE8_12: Sustainable design (for recycling, for environment, eco-design)
- PE8_16: Architectural engineering
- SH5_6: History of art and architecture, arts-based research
- SH5_7: Museum, exhibitions, conservation and restoration
- SH5_8: Cultural studies, cultural identities and memories, cultural heritage