

Research Group

REsilience of Structures - REST

Reference year:

2024

Scientific Coordinator:

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

Group members:

MARINO BORRELLI / Full Professor / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

GIANFRANCO DE MATTEIS / Full Professor / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

GIUSEPPE FAELLA / Full Professor / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

GIORGIO FRUNZIO / Associate Professor / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

SERGIO RINALDI / Associate Professor / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

MARCO BORRELLI / Researcher / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

MARIATERESA GUADAGNUOLO / Researcher / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

ROBERTO SERPIERI / Researcher / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

CORRADO CHISARI / Researcher / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

MATTIA ZIZI / Researcher / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

PASQUALE BENCIVENGA / PhD Student / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

LUCIANA DI GENNARO / PhD Student / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

LUIGI MASSARO / PhD Student / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

JAFAR ROUHI / PhD Student / DADI / Università degli Studi della Campania “Luigi Vanvitelli”

Description of research lines:

1 – Resilience of reinforced concrete structures (Coordinator: Prof. Giuseppe Faella)

Reinforced concrete had its greatest development in Italy in the years after World War II. It was believed that r/c could guarantee structural safety over time. About 70 years after that period, there is a growing awareness that this material also has its own life cycle. Today many buildings show a considerable degradation. The research aims at investigating the degradation phenomena, the parameters that accelerate degradation, the effects to be controlled, also by innovative techniques. Analysis of existing buildings and laboratory tests are involved.

2. – Resilience of churches (Coordinator: Prof. Gianfranco De Matteis)

This research line deals with studies aimed at analyzing the problems related to the assessment of seismic vulnerability and safeguarding of historic buildings. Through the identification of the prevailing historical-architectural and constructive characteristics, as well as through the recognition of the seismic capacity and the main fragilities connected to the behavior of structures, new predictive models of vulnerability are proposed, also aimed at simplifying the applications on territorial scale. Starting from the scientific background gathered on more complex buildings (churches), the study of techniques is currently aimed at analyzing two structural types that are immediately recognizable, such as bell towers and brick bridges. The methodology developed 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 metallic materials) capable of extending their residual life, in full respect of the architectural value of the assets considered.

3 – Resilience of wood structures: From tradition a new renewable material to increase the safety of the existing (Coordinator: Prof. Giorgio Frunzio)

Wood, in all its essences, has been used in civil construction, albeit dimensional limits, anisotropy and perishability when not adequately protected. In recent times, innovation allowed new products derived from wood such as glulam, CLT and all reconstituted products derived from processing and recycling waste. It is appropriate to deepen the knowledge about the properties of the materials that are gradually developing by the industry, also to test and code them. Finally, the possibility to strengthen existing buildings through timber elements and systems is valued. Such a technique allow reversible and replacement, rapid execution with reduced environmental impact. All these conditions are usually necessary in volumetric requalification/addition on recent buildings and Cultural Heritage.

4 – Resilience of masonry structures (Coordinator: Prof. Mariateresa Guadagnuolo)

The current substantial opportunities for transformation of / on the built induce to consolidate and strengthen the theme of composition research on a large part of the "minor" buildings that testify to a constant dialogue with the past and confirm the need for the project culture of "layering." The fabric of the historic centers is not represented by the mere tight coexistence of old and new architecture, one next to the other, but proposes characters of resilience due to the successive stratifications of spatial stylistic and morphological-functional units that allow man and his habits and needs to adapt to the continuous transformations of contemporaneity. The shaping of new uses related to the contemporary man must contemplate the aesthetic experience of the inhabitant of Pontian memory who is no longer passively a spectator subject but becomes a protagonist in the process of reactualization of architecture and its envelope starting from the interior/architectural

space.

The seismic safety of the existing masonry heritage, obvious, is essential. This topic, however, needs further investigation despite the numerous researches developed in recent years. The research concerns the definition and development of structural models and numerical procedures for static and dynamic analysis of masonry structures, development of innovative and specific software for the seismic safety assessment of existing structures, analysis and methods for the seismic vulnerability assessment of complex monumental structures, definition of innovative consolidation techniques.

5 – Numerical modelling of sustainability of materials and structures subjected to mechanical and chemical deterioration (Coordinator: Prof. Roberto Serpieri)

This research line aims at achieving, by advanced numerical modelling methods, a deeper knowledge of the effect of mechanical and chemical deterioration over resilience and physical and functional integrity of materials and structures which deserve special attention due to their architectural value or due to their diffusion among the Italian building stock. Attention is also directed towards materials and structures which have been recently object of structural collapse with seemingly marked fragile kinematics (such as those occurred on August 14th 2018 to a segment of the Polcevera viaduct or on April 8th 2020 to a bridge on the Magra), and for which a contribution of mechanical and chemical deterioration may be argued. Research goals are primarily directed towards the life cycle assessment of structures and of the built environment within management policies for the qualification, preservation, sustainability and regeneration of the Italian building stock, with an ecosystemic approach.

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

Il gruppo REST 2024 interagisce con i gruppi di ricerca:

- **StandardF-AU / StandardF** del Dipartimento di Architettura e Disegno Industriale;
- **SicurEzza strutturale e sismiCa delle CostrUzioni Rilevanti Esistenti: edifici e ponti (SECURE)** del Dipartimento di Architettura e Disegno Industriale;
- **LANDesign** del Dipartimento di Architettura e Disegno Industriale.

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 personnel: Prof. Ing. Gianfranco De Matteis (Responsabile scientifico Unità di Ricerca), 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: Proponente: 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., BASF S.r.l., TELENIA S.r.l., Etna Hitech S.c.P.A., Fibre Net S.r.l.

State of the project: positively evaluated/funded/end date

Submission date: 9-11-2017/01-01-2023/30-06-2025.

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. Ing. 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: funded

Starting/closing date: from 01/01/2022 to 31/12/2024

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

Principal Investigator: Prof. Eng. 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: Gianfranco De Matteis, Corrado Chisari, Giorgio Frunzio, Mariateresa Guadagnuolo, Pasquale Bencivenga, Jafar Rouhi.

Partner institutions: POLIMI, UNIUD, UNICT, UNIPD

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

Partners: Intra-University project competition

Project status: funded

Submission date/Start/End of the project: start: December 2nd, 2019/December, 2nd, 2022

Title of the project: ARCH

Principal Investigator: 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: Corrado Chisari

Partner institutions: nessuno

State of the project: funded

Starting date: 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. Ing. 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: Prof. Eng. Gianfranco De Matteis, Eng. Mattia Zizi

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

Project status: submitted / funded

Submission date/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: Prof. Eng. Gianfranco De Matteis, Dr. Eng Corrado Chisari

Partners: -

Project status: funded

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

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 (co-PI)

Partner institutions: University of Padova and University of Perugia

State of the project: submitted

Submission date: 30-11-2022.

Title of the project: STARES

Principal Investigator: Dott. Arch. Vincenzo Cirillo

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: STARES will investigate masonry staircases using inter-disciplinary state-of-art criteria, techniques, and tools for the preparation of knowledge models useful for critical analysis, recovery, and enhancement of the asset.

Involved Staff: Corrado Chisari, Ornella Zerlenga, Pasquale Bencivenga

Partner institutions: ---

State of the project: eligible, not funded

Submission date: 08-07-2022.

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, Luciana Di Gennaro

Partner institutions: ---

State of the project: Positively evaluated/funded/ongoing

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

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: High-performance materials for sustainable structures

Scientific Coordinator: Vincenzo Piluso (UNISA)

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 (responsabile di unità), Mariateresa Guadagnuolo

Partners: UNICAMPANIA, UNIPD, UNICT

Project status: not funded

Submission date/Start/End of the project: 27.03.2022

Title of the project: Structural Assessment and development of innovative saFEguard Measures fOr hisTOriCal masONry towers_SAFEMOTION

Scientific Coordinator: Gianfranco De Matteis

Call title: PRIN22-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 expertises of the research units (Rus) 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, Mattia Zizi

Partners: UNIPD, UNIUD

Project status: funded

Submission date/Start/End of the project: 30.11.2022

Scientific products of the last three years:

20 scientific products of which at least 10 on Class A journals and/or indexed in Scopus/WoS databases:

- [1] Guadagnuolo M., Aurilio M., Nuzzo M., Faella G., (2022). Historic chimney stacks: seismic assessment and kinematic analysis, *Journal of Architectural Engineering*, ASCE. doi.org/10.1061/(ASCE)AE.1943-5568.0000571.
- [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] Bencivenga, P., Zizi, M., & de Matteis, G. (2022). Masonry Arch Bridges: Typical Features and Structural Issues. In *Lecture Notes in Civil Engineering: Vol. 200 LNCE*. https://doi.org/10.1007/978-3-030-91877-4_62.
- [5] Monaco, M.; Faella, G.; Guadagnuolo, M. Analysis Of Pozzolan Mortars For Restoration. *International Journal of Conservation Science* 2021, 12(1) pp.41-50.
- [6] Bossio, A.; Faella, G.; Frunzio, G.; Guadagnuolo, M.; Serpieri, R. Diagnostic Reliability in the Assessment of Degradation in Precast Concrete Elements. *Infrastructures* 2021, 6, 164. https://doi.org/10.3390/infrastructures6110164.
- [7] Monaco, M.; Aurilio, M.; Tafuro, A.; Guadagnuolo, M. Sustainable Mortars for Application in the Cultural Heritage Field. *Materials* 2021, 14, 598. https://doi.org/10.3390/ma14030598
- [8] Zizi, M.; Campitiello, F.; De Matteis, G. A retrofitting technique using steel grids for existing masonry panels: a numerical and analytical study. 2021. in *Bulletin of Earthquake Engineering - ISSN:1573-1456*. DOI:10.1007/s10518-020-01030-8.
- [9] Zizi, M.; Cacace, D.; Rouhi, J.; De Matteis, G.; Lourenço, P. Automatic procedures for the safety assessment of stand-alone masonry arches. 2021. in *International Journal of Architectural Heritage - ISSN:1558-3066*. DOI:10.1080/15583058.2021.1881655.
- [10] Zizi, M.; Corlito, V.; Lourenço, P.; De Matteis, G. Seismic vulnerability of masonry churches in Abruzzi region, Italy. 2021. In *Structures – ISSN:2352-0124*, vol 32, pp. 662-680. DOI: 10.1016/j.istruc.2021.03.013.
- [11] Chisari C, Cacace D, De Matteis G, 2021. Parametric Investigation on the Effectiveness of FRM-Retrofitting in Masonry Buttressed Arches. *Buildings* 11, 406. DOI: 10.3390/buildings11090406.
- [12] Serpieri, R.; Monaco, M., 2023. A percolation-threshold model for evaluating permeability in

Portland pastes with high water-cement ratio. *Journal of Building Engineering*, 70, 106328.

[13] Monaco, M., Serpieri, R., Guadagnuolo, M., & Frunzio, G. (2023). A Discussion on the Determination of Permeability and Absorption in Concrete. In *RILEM Bookseries* (Vol. 41). <https://doi.org/10.1007/978-3-031-29191-3>.

[14] Guadagnuolo M., Faella G., Frunzio G., Massaro L., Brigante D., (2022). The capacity of FRP anchors in concrete and masonry structures, XIX Convegno di Ingegneria sismica in Italia, Torino, Italy, September 11-15, 2022.

[15] Guadagnuolo M., Di Gennaro L., Basile A., De Matteis G., (2022). Simplified methods for the evaluation of mechanical properties of tuff masonry walls in Campania (Italy), XIX Convegno Ingegneria sismica in Italia, Torino, Italy, September 11-15, 2022.

[16] Massaro, L., Serpieri, R., Frunzio, G., & di Gennaro, L. (2023). Timber carpentry without steel connectors. in proceedings of COMPDYN, 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Athens, Greece, 12-14 June 2023.

[17] Borrelli, M. "Nuove Spazialità Museali" in *Architecture Open Source* ISBN: 978-88-944172-3-4 prima edizione Aprile 2023 prodotto disponibile per la consultazione sulla piattaforma digitale Calameo pagg 122. <https://www.calameo.com/books/00399128672ac32fa8a20>.

[18] D'Amato, M., Luchin, G., De Matteis, G. (2023). A Preliminary Study on Properties of a Weak Units–Strong Mortar Masonry: The Case Study of Matera Tufo Masonry (Italy). *International Journal of Architectural Heritage*, 17(7), 1115-1136.

[19] Guadagnuolo M., Di Gennaro L., Basile A., De Matteis G., (2023). Simplified methods for the evaluation of mechanical properties of tuff masonry walls in Campania (Italy), *Procedia Structural Integrity*, Volume 44. <https://doi.org/10.1016/j.prostr.2023.01.114>.

[20] Massaro, L.; Di Gennaro, L.; Guadagnuolo, M.; Frunzio, G. Strengthening of Masonry Arches: the "Santa Maria delle Grazie" Church, in proceedings of COMPDYN, 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Athens, Greece, 12-14 June 2023.

Relationships with international and national Companies, Institutions, Research Centers, Universities during the last three years:

- The group's research has relationships with the research activities of the research project "Studies and research on cultural and landscape heritage for the tourist development of the territorial areas of the Campania Region", funded by the Campania Region to the "Società Progetto Laocoonte S.c.p.a. - Research Institute". Lead scientist: Prof. Giuseppe Faella.
- 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". 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: Corrado CHISARI
- Agreement for research activities with "Laboratorio TecnoLab srl - Construction Materials Testing Laboratory" in Naples. Lead scientist: Mariateresa GUADAGNUOLO

- Memorandum of understanding with SUNTA srl technological advances for dynamic identification of masonry structures (2019_to date);
- Relationships with ARISTOTELE UNIVERSITY OF THESSALONIKI (Greece) within the Erasmus+ Teachers' and PhD students' Mobility Programme.
- Relationships with Universidade NOVA de Lisboa (Portogallo) within the Erasmus+ Teachers' and PhD students' Mobility Programme.
- Relationships with Departamento de “Construcciones Arquitectónicas y su Control “. Universidad Politécnica de Madrid). ETSEM. ESPAÑA.

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

- The group's research interacts with the research activities of Benecon Scarl.
- 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:

- ICAR08
- ICAR09
- ICAR12
- ICAR14
- ICAR16

Keywords:

- Masonry
- Wood
- Vulnerability Cultural Heritage
- Seismic safety
- Churches

- Non-structural elements
- Consolidation interventions
- Bridges
- Steel Structures
- Experimental testing

ERC Categories:

- PE8_3 Civil engineering, maritime/hydraulic engineering, geotechnics, waste treatment
- PE8_4 Computational engineering
- PE8_8 Mechanical and manufacturing engineering (shaping, mounting, joining, separation)
- PE8_9 Materials engineering (biomaterials, metals, ceramics, polymers, composites...)
- PE8_12 Sustainable design (for recycling, for environment, eco-design)
- PE8_16 Architectural engineering