Research Group

BIM technology and material innovation: from efficiency to environmental compatibility

Reference year: 2024
Scientific Coordinator: FRANCHINO ROSSELLA/ Associate Professor / Department of Architecture and Industrial Design (DADI) / Università degli Studi della Campania "Luigi Vanvitelli"
Group members: -CANNAVIELLO Monica/ Assistant Professor / DADI / Università degli Studi della Campania "Luigi Vanvitelli" -DONATO Alessandra / Laboratory technician / Dipartimento di Architettura (DiDA), Università degli Studi Firenze -FRANCHINO Rossella/ Associate Professor / DADI / Università degli Studi della Campania "Luigi Vanvitelli" -FRETTOLOSO Caterina / Associate Professor / DADI / Università degli Studi della Campania "Luigi Vanvitelli" -GALLO Paola / Associate Professor / Dipartimento di Architettura (DiDA) / Università degli Studi Firenze -MAZZONI Elisa / Ph.D. Student / Dipartimento di Architettura (DiDA) / Università degli Studi Firenze -MEROLA Marica/ Research fellow / Dipartimento di Ingegneria / Università degli Studi della Campania "Luigi Vanvitelli" -PISACANE Nicola / Associate Professor / DADI / Università degli Studi della Campania "Luigi Vanvitelli" -ROMANO Rosa / Associate Professor / Dipartimento di Architettura (DiDA) / Università degli Studi Firenze -VIOLANO Antonella / Associate Professor / DADI / Università degli Studi della Campania "Luigi Vanvitelli" - ZERARI Salima / Ph.D. Student / DADI / Università degli Studi della Campania "Luigi Vanvitelli"
Description of research lines: The interdisciplinary research group is mainly interested in finding solutions oriented to the application of BIM technology at the management of the building process, focusing on the role that this digital platform has in the choice and evaluation of different materials use in relation to their performance over the entire life cycle building. Specifically, the research activity explores the role

that BIM technology can play in controlling the environmental dimension of innovative building materials and, therefore, proposes the development of a set of criteria that can describe in terms of compatibility the material quality. These criteria, by putting in system more requirements (from the saving of natural resources to the mitigation and reduction of environmental impact), allow to define for each material the limitation of the footprint and the identification of the load capacity of the same, that is, the ability to absorb and control the phenomena of environmental changes with a sustainable impact on the ecosystem. The integration between BIM technology and control criteria for the evaluation of innovative materials in the building sector is one of the most significant elements of the research providing a decision-making and control tool of the processes of obsolescence in existing building recovery and in the 'ex-novo' eco-oriented design. The BIM technology, in fact, digitally reconstructing not only the geometry of a building but proposing a virtual clone, is a support tool for the project in all its phases, allowing better control than the established traditional processes. Finally, the technological approach contribution allows to be broadened the dialogue boundaries between the building and the surrounding environmental context, which in this way can also take place through the careful use of materials.

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

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Participation in research projects during the last three years:

Project title: *Green/blue/grey integration for climate adaptive urban design*
Coordinator: Prof. R. Franchino
Call title: Erasmus+ Call 2024 - Blended Intensive Programmes (BIP)
Abstract: *The proposed work aims to identify strategies for functional and dimensional insertion and adaptation of green/blue infrastructure in urban contexts characterized by high building density and with a focus on the inclusive dimension of design.*
Involved persons: prof. Christian Werthmann - Leibniz University Hannover - Germania and prof. Tobias Baur -Eastern Switzerland University of Applied Sciences (OST) - Svizzera
Partners: Dreiseitl consulting (arch. Herbert Dreiseitl and arch. Bettina Dreiseitl - Wanschura)
Status: eligible
Project submission: november 2023

Project title: *Geopolymers for Advanced Eco-Architecture: A Chemo-rheology and Thermo-kinetic investigation for the development of 3D Printable formulations - GEA*
Scientific coordinator: Dott.ssa Laura Ricciotti
Call title: PRIN: Progetti di Ricerca di rilevante interesse nazionale - Bando 2022 PNRR
Abstract: *The project deals with optimizing geopolymer formulations, through the alkaline activation of different kinds of aluminosilicate wastes, for their use as materials, in the 3D-printing of advanced housing units in sustainable buildings. The project aims to develop an innovative strategy to overcome the main limits of a large-scale application of 3D printing of geopolymer materials through a systemic and highly interdisciplinary approach*
Involved persons: Proff. Raffaella Aversa, Rossella Franchino, Caterina Frettoloso, Gino Iannace, Nicola Pisacane, Salima Zerari
Partners: Università degli Studi della Campania "Luigi Vanvitelli", Università degli Studi "G. d'Annunzio" CHIETI-PESCARA

Status: funded
Project submission: november 2022

Project title: *RE.VI.VE 4.0 Intersystemic models and digital transcalar meta-design platforms to REstore VIllages attractiVEness 4.0*
Scientific coordinator: Prof. Rossella Franchino
Call title: PRIN: Progetti di Ricerca di rilevante interesse nazionale - Bando 2022
Abstract: *The proposed research activity is oriented to digital platforms use to support the meta-design phase with a tran-scalary approach in order to outline a methodology that can direct the transformation/regeneration processes of small villages in a circular logic*
Involved persons: Proff. Alessandra Avella, Rossella Franchino, Caterina Frettoloso, Nicola Pisacane, Francesca Muzzillo
Partners: Università degli Studi della Campania "Luigi Vanvitelli", Università degli Studi "G. d'Annunzio" CHIETI-PESCARA
Status: not funded
Project submission: march 2022

Project title: GEA - *Geopolymers for Eco-Architecture: A Chemo-rheology and Thermo-kinetic investigation for the development of 3D Printable formulations*
Scientific coordinator: Dott.ssa Laura Ricciotti
Call title: Bando per il finanziamento di progetti di ricerca fondamentale ed applicata dedicato ai Giovani Ricercatori D.R. 509/2022
Abstract: *The project deals with optimising geopolymers (inorganic-based polymer formulations) for their use as materials for the 3D printing of new housing units in sustainable buildings*
Involved persons: Proff. Raffaella Aversa, Marino Borrelli, Rossella Franchino, Caterina Frettoloso, Gino Iannace, Francesca Muzzillo, Nicola Pisacane, Laura Ricciotti
Status: funded
Project submission: July 2022

Project title: *Rethinking post disaster recovery phase (FARO)*
Scientific coordinator: Prof. Scira Menoni;
Departmental Scientific coordinator: Prof. Adriana Galderisi;
Call title: Progetti di Ricerca di rilevante interesse nazionale – Bando PRIN 2020 - Ministero dell'Università e della Ricerca
Abstract: *Faro aims at providing operational tools to support agencies in charge of reconstruction following a disaster, focusing on the recovery phase, intended as the transition between emergency and advanced reconstruction when a new normalcy must be sought and the pressure between bouncing back and the need to develop strategies for the future is at its peak*
Involved persons: Proff. Adriana Galderisi, Nicola Pisacane, Rossella Franchino, Caterina Frettoloso, Giuseppe Guida.
Partners: Politecnico di Milano, Università degli Studi della Campania "Luigi Vanvitelli" - Dipartimento di Architettura e Disegno Industriale, Università della Calabria, Università degli Studi dell'Aquila, Università degli Studi di Ferrara
Status: not funded
Project submission: January 2021

Title of the project: *PURE - Productive and Urbanism Resources. Eco-Solutions for new land*

Scientific coordinator: Prof. Giuseppe GUIDA
Call title: VALERE 2020 Program: Research project for Researcher (type A and B)
Applicant Body: Università della Campania "Luigi Vanvitelli"
Abstract: *Data and maps collection from ASI, Caserta District, Campania Region, Cassa del Mezzogiorno-ASET, to define criteria for analysis, classification and mapping of brownfield or underused areas. Catalogue editing for eco-solutions already tested, with a focus on soil restoration, reuse of waste materials (in particular CDWs), ecological techniques suitable for brownfields area. Analysis and design results application to the experimental area.*
Involved persons: Proff. Francesca Castanò. Rossella Franchino, Caterina Frettoloso, Giuseppe Guida, Nicola Pisacane
Partners: Consorzio ASI della Provincia di Caserta (Caserta District ASI Consortium), Assessorato al Governo del Territorio della Regione Campania (Campania Region Department of Territorial Government)
Status: funded
Project submission /starting/ending: 2020/2020/2021

Scientific products of the last three years:
10 scientific publications in Class A journals and/or indexed in the Scopus/WoS databases:

[1] ZERARI S., FRANCHINO R., PISACANE N. (2023). The potential impacts of using bio-based building materials on human health and wellbeing. In: (a cura di): E. Zervas, Proceedings of 4th International Conference on Environmental Design (ICED2023). E3S WEB OF CONFERENCES, vol. 436, ISSN: 2267-1242, Athens, Greece, 20-22 October 2023, doi: 10.1051/e3sconf/202343601006 (SCOPUS)
[2] DE MARTINO R., FRANCHINO R., FRETTOLOSO C. (2023). A "Stepping Stone" Approach to Exploiting Urban Density. In: AA. VV. (a cura di): E. Arbizzani E. Cangelli C. Clemente F. Cumo F. Giofrè A. M. Giovenale M. Palme S. Paris, EditorsTechnological Imagination in the Green and Digital Transition. THE URBAN BOOK SERIES, p. 639-648, Gewerbestrasse:Springer, ISBN: 978-3-031-29515-7, ISSN: 2365-7588, doi: 10.1007/978-3-031-29515-7_57 (SCOPUS)
[3] AVERSA R., FRANCHINO R., FRETTOLOSO C., PISACANE N., RICCIOTTI L. (2023). Geopolymers for Eco-Architecture. Integrated approaches for green strategies activation. AGATHÓN, vol. 13, p. 237-246, ISSN: 2464-9309, doi: 10.19229/2464-9309/13202023 (RIVISTA CLASSE A) (SCOPUS)
[4] FRANCHINO R., FRETTOLOSO C., PISACANE N. (2022). BUILT ENVIRONMENT TRANSFORMATIONS: BIM AND CIRCULAR APPROACH. In: SMC - Sustainable Mediterranean Construction, (16), p. 156-163, ISSN: 2420-8213. (RIVISTA CLASSE A) (SCOPUS)
[5] FRANCHINO R., FRETTOLOSO C. (2022). Eco-innovative approaches as activators of the environmental reconstruction of compromised contexts. In: TECHNE - Journal of Technology for Architecture and Environment, (23), p. 134-145, ISSN: 2239-0243, https://doi.org/10.36253/techne-12109. (RIVISTA CLASSE A) (SCOPUS)
[6] FRANCHINO R., FRETTOLOSO C. (2022). Integrated green strategies to make cities more liveable. In: Abitare la Terra - Dwelling on Earth, Quaderni 7-8, p. 64-67, ISSN: 1592-8608. (RIVISTA CLASSE A)
[7] PISACANE N. (2022). The drawing of a territorial infrastructure. The case study of the 'Carolino' Aqueduct (Italy). In: International Archives of the Photogrammetry, Remote Sensing

and Spatial Information Sciences, vol. XLVIII-4/W3-2022, p. 119-126, ISSN: 2194-9034, doi: 10.5194/isprs-archives-XLVIII-4-W3-2022-119-2022 (RIVISTA CLASSE A)

[8] FRANCHINO R., (2021). Interaction Between Anthropic and Natural Phenomena in Urban Contexts Re-equilibration. In: Giacomo Chiesa (a cura di), Bioclimatic Approaches in Urban and Building Design. p. 243-254, Springer, ISBN: 978-3-030-59327-8. (SCOPUS)

[9] VIOLANO A., CAPOBIANCO L., CANNAVIELLO M. (2021). THE FUTURE NOW: An adaptive tailor-made prefabricated Zero Energy Building. In. TECHNE, vol. Special Issue 2/2021, p. 122-127, ISSN: 2239-0243. (RIVISTA CLASSE A)

[10] ROMANO R., GALLO P., DONATO A. (2021). Smart materials for Adaptive façade systems. The case study of SELFIE components. In: J. Littlewood, R. J. Howlett, L. C. Jain (a cura di), Smart Innovation, Systems and Technologies, SUSTAINABILITY IN ENERGY AND BUILDINGS 2020, pp. 285-296 Springer, ISBN:978-981-15-8783-2. (SCOPUS)

Additional 10 scientific products:

[1] FRANCHINO R., PISACANE N., ZERARI S. (2023). THE TEACHING OF INNOVATIVE SUSTAINABLE MATERIALS ACCORDING TO THE ASPECTS OF TECHNOLOGY AND MODELLING. In: (a cura di): L. Gómez Chova C. González Martínez J. Lees, 16th International Conference of Education, Research and Innovation. p. 7957-7962, Valencia:IATED Academy, ISBN: 978-84-09-55942-8, Seville, Spain, November 13th–15th, 2023, doi: 10.21125/iceri.2023

[2] A. VIOLANO A., CANNAVIELLO M. (2023). NATURE BASED SOLUTIONS: La progettazione eco-orientata di spazi aperti resilienti. In: AA.VV. (a cura di): Marina Fumo e Antonella Violano, IM-MUTAZIONI. L'altro volto della piazza. p. 9-18, Napoli:Luciano Editore

[3] ZERARI S. FRANCHINO R., PISACANE N. (2022). An overview of innovative construction materials for enhancing the sustainability of buildings and their integration into BIM. In: JOURNAL OF ENGINEERING RESEARCH, vol. 2, ISSN: 2764-1317, doi: 10.22533/at.ed.3172242226106

[4] FRETTOLOSO C., FRANCHINO R., GALLO P. (2022). Urban environments regeneration. Technological issues for adaptive re-use. In: (a cura di): C. Gambardella, BEYOND ALL LIMITS Proceedings on International Conference on Sustainability in Architecture, Planning, and Design. p. 173-177, DADI _ PRESS, ISBN: 9788885556232, Monumental Complex of the Real Belvedere of San Leucio, Caserta – Italy, 11-12, 13 May_2022

[5] FRANCHINO R., FRETTOLOSO C. (2022). Environmental issues and industrial landscapes_Adaptive strategies and Nature-based technology for the regeneration of fragile environments. In: G. Guida (a cura di), THE INDUSTRIAL DEVELOPMENT AREAS The case of Caserta. p. 70-75, DADI _ PRESS, ISBN: 978-88-85556-21-8

[6] DE MARTINO, FRANCHINO R. (2021). The role of green infrastructure in the regeneration interventions of anthropized context. In: P. La Greca A. Sgobbo e F. D. Moccia (a cura di), URBAN DENSITY & SUSTAINABILITY. p. 133-140, MAGGIOLI EDITORE, ISBN: 978-88-916-4650-7

[7] FRANCHINO R., FRETTOLOSO C., PISACANE N. (2021). URBAN OPEN SPACES RE-USE: DESIGN STRATEGIES. In: Cleiseano Emanuel da Silva Paniagua (a cura di), Coleção desafios das engenharias: engenharia sanitária 2. p. 269-280, Atena Editora, ISBN: 978-65-5983-537-9, doi: 10.22533/at.ed.379211310

[8] FRANCHINO R., FRETTOLOSO C., PISACANE N. (2021). Parametric modeling and remote teamwork: an educational experience. In: L. Gómez Chova A. López Martínez I. Candel Torres

(a cura di), INTED2021 Proceedings 15th International Technology, Education and Development Conference. p. 6189-6197, IATED Academy, ISBN: 978-84-09-27666-0

[9] FRANCHINO R., FRETTOLOSO C. (2021). ANTHROPIC SETTLEMENTS AND NATURAL LANDSCAPE. ABITARE LA TERRA, vol. 6, p. 38-39, ISSN: 1592-8608

[10] FRANCHINO R., FRETTOLOSO C. (2021). Innovative materials in technology teaching: training approaches and design experiments. In: L. Gómez Chova A. López Martínez I. Candel Torres (a cura di), ICERI 2021 Conference Proceedings 14th International Conference of Education, Research and Innovation. p. 6246-6250, IATED Academy, ISBN: 978-84-09-34549-6

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

Interuniversity Center for Bioecological Architecture and Technological Innovation for the Environment ABITA -Università degli Studi di Firenze (Italy)
Laboratory TAM Technologies for Mediterranean Living -Università degli Studi di Firenze (Italy)
EDIL-TEST S.r.l. -Battipaglia (SA) (Italy)

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

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ISI Web of Science Subject Categories:

- Architecture
- Engineering Civil

Scientific-Disciplinary Sectors:

- ICAR/12
- ICAR/17

Keywords:

- data base
- environmental compatibility
- innovative materials
- material load capacity

ERC Categories:

-PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics
-PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling,
regeneration or recovery of compounds, carbon capture & storage