RESCUE Lab
suRvEy and Structural engineering to safeguard the CUltural heritagE
A - Integrated digital survey
B - Structural safety and monitoring

Principal Investigator: A - Prof. arch. Ornella Zerlenga, CEAR-10/A, Disegno (ex SSD ICAR/17) B - Prof. ing. Gianfranco De Matteis, CEAR-07/A Tecnica delle costruzioni (ex SSD ICAR/09)
Responsible of teaching and research activities in the laboratory (R.a.d.o.r.): A - Dott. arch. Domenico Iovane, CEAR-10/A, Disegno (ex SSD ICAR/17) B - Prof. ing. Corrado Chisari, CEAR-07/A Tecnica delle costruzioni (ex SSD ICAR/09) (appointment / nomination proposal approved in the CdD no. 8 of 30 April 2024)
Location: RESCUE Lab (Section A, B) is located on the ground floor of the Department of Architecture and Industrial Design of the University of Campania “Luigi Vanvitelli” [Abbazia di S. Lorenzo ad Septimum, via San Lorenzo, 4 – 81031, Aversa (CE)].
Main Laboratory Activities: The RESCUE Lab Laboratory was born from the scientific synergy of professors and researchers belonging to the Scientific Disciplinary Sectors of 'Design' and 'Construction Technique' of the Department of Architecture and Industrial Design of the University of Campania "Luigi Vanvitelli". The interdisciplinary approach, which combines skills in architecture, engineering and conservation of cultural heritage, allows us to obtain innovative and customized solutions for each type of intervention. The Laboratory is configured as an experimental center of scientific research through innovative methodologies and tools aimed at the creation of numerical and/or photorealistic digital models of the archaeological, historical and/or contemporary heritage (Section A), as well as the analysis of their structural safety and monitoring over time (Section B). In addition, it carries out support activities for advanced teaching in the areas described. The activities are also carried out in relation to research projects and/or agreements with other public/private Institutes. **Section A - Integrated digital survey:** Currently, Section A of the laboratory comprises the following research areas: 1. Innovative digital survey; 2. Visualization through Reality-based models.

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Innovative digital survey

All the activities aimed at the experimentation of innovative methodologies and digital instruments for both terrestrial and aerial surveying converge within this field of research. The latter are functional to the multiscale and multidimensional knowledge of Cultural Heritage in terms of critical collection of quantitative and qualitative data that characterize it.
The disciplinary skills can be summed up as follows by starting from the knowledge of scientific sources and analysis of technical-cultural trends:

1. defining procedural protocols;
2. identifying the best performing instruments for the case study;
3. conducting multi-scale and multidimensional digital surveys using technologies based on natural and/or structured light;
4. performing point surveys with high degree of accuracy.

Visualization through Reality-based models

Within this research section, critical activities aimed at the application and experimentation of innovative information and communication technologies (ICT) converge. These technologies are functional to the enhancement of cultural heritage in terms of visualizing the quantitative and qualitative data that characterize it.
Starting from an awareness of scientific sources and an analysis of technical and cultural trends, the sector's competencies allow for:

1. identifying practices aimed at expanding conscious enjoyment;
2. defining systems aimed at providing new accessibility (physical and/or digital) where it is currently denied;
3. activating protocols to restore spatial visualization (physical and/or digital) through point, polygonal, parametric, and physical models;
4. conducting graphic analyses on the configuration of architecture and the environment;
5. managing and representing databases;
6. designing multimedia environments.

Section B - Structural safety and monitoring:
The laboratory focuses on the structural assessment of cultural heritage through non-destructive in-situ techniques and continuous monitoring. The main objective is to ensure the preservation and safety of historic buildings, monuments and other valuable works, without compromising their integrity. The laboratory uses advanced instruments such as ultrasound, georadar and vibration analysis techniques to assess the structural condition of structures without the need for invasive interventions, also making use of the most advanced data processing techniques. These methodologies make it possible to obtain information on the state of the structure and the quality of the materials, identifying any degradation, instability or internal problems that could compromise the static and seismic safety of the asset.

In addition, the laboratory develops and applies real-time monitoring systems to track the evolution of structural conditions over the long term. By using sensors and devices to measure displacement,

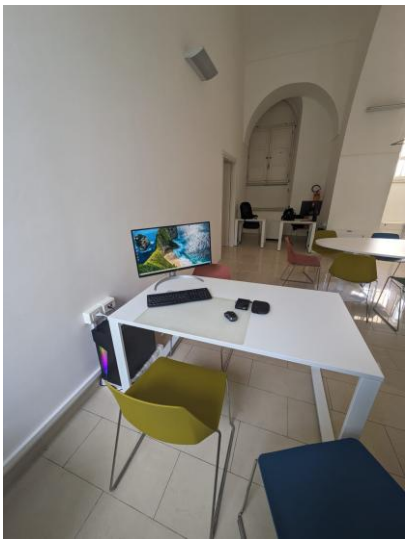
speed, acceleration, and other physical variables, you can take early action in the event of a problem. The interdisciplinary approach, which combines engineering, architecture and cultural heritage conservation skills, allows for innovative and customized solutions for each type of intervention.

Main equipment:

Section A - Integrated digital survey:

- DJI Mavic 2 Enterprise Dual (double sensors in the visible and infrared spectrum);
- DJI Mavic Mini 2 (sensor in the visible spectrum);
- Camera lens - Nikon - Nikkor F. Afd. 35 mmf/2D;
- Camera lens - Nikon - Nikkor F. Afd. 50 mmf/1.4D;
- Camera lens - Nikon - Nikkor F. Afd. 70-80mmf/4.5-5.6D;
- Camera lens - SIGMA - AF-MF ZOOM LENS. 15.30mm F3.5-4.5 EX DG ASPHERICAL;
- Camera - Nikon - F70;
- Camera - Nikon - Digital Camera E3/E3s;
- Camera - KUJIFILM - FinePix S2 Pro;
- Laser distance meter - Leica - DistoTM pro4;
- Laser distance meter - Leica - AG Heerbrugg;
- GPS Total Station - Trimble Navigation - TRM 5700;
- GPS Receiver - Trimble - TRM 5700;
- Mobile support - Manfrotto;
- Prism total station - NIKON - 6402;
- Protective glasses - Crystal EYES - Stereographics;
- Batteries - Leica - GEB70;
- Tricuspid/prism adapter/battery charger (forced centering) - NIKON - DTM-720; - Counterbalance;
- Total Station - NIKON - DTM-720;
- Batteries - Leica - GKL23;
- Telescopic rod (2 m) with topoghaphical base - Trimble;
- Telescopic rod with circular topographic base up to 5 m (x2);
- Topographical tripods (x5) - NIKON;
- Photographic tripods - Trimble;
- Photographic tripods - Manfrotto - 132XN;
- Thopographical ranging pole (1.30 m);
- Total station – Leica - Modello TS460;
- ScanStation P50 – Leica – long range terrestrial laser scanner;
- Laser scanner 3D RTC360 – Leica - medium range terrestrial laser scanner;
- Workstation (1) – Motherboard Msi Meg Z790 Ace MaxZ790 Intel Atx 4xDDR5 – CPU Intel Core i9-14900KF 3.2 GHz/6GHz LGA1700 Box – SSD 4TB – Ram DIMM DDR5 192GB – Video card nVidia Pny 48 GB RTX A6000 4xDP;

- Workstation (2) - Motherboard Msi Meg Z790 Ace MaxZ790 Intel Atx 4xDDR5 – CPU Intel Core i9-14900KF 3.2 GHz/6GHz LGA1700 Box – SSD 4TB – Ram DIMM DDR5 192GB – Video Card nVidia VGA GeForce RTX 4090 24GB GameRock OC.



Section B - Safety and structural monitoring

- Static and dynamic acquisition unit DDAS 36 channels;
- Drone DJI Mini 3;
- Go Pro Hero 11;
- Videoendoscope RiTec RI 1320 SLC;
- Camera NIXON Colpix;
- SLR camera CANON EOS 850;
- All-in-one control unit for sonic and ultrasonic tests with dedicated tablet;
- n. 4 MEMS accelerometers with 50 m cables;
- n. 4 Triaxial force-balance accelerometers with 30 m cables;
- n. 2 Biaxial Force Balance accelerometers with 30 m cables;

- n. 3 Temperature sensors with 30 m cables;
- n. 2 Triaxial seismometers with 30 m cables;
- Covermeter Elcometer P331;
- Mechanical sclerometer for concrete;
- Mechanical penetrometer for mortar;
- n. 5 Crack meters/inclinometers;
- n.1 Laser distance meter Leica DISTO X3 P2P-Package with tripod;

Associated Research Groups:
Knowledge, valorisation and digital communication of Cultural Heritage.
SECURE, Structural and sEismiC safety of strategic and relevant existing constrUctions buildings and bRidgEs.

Reference Scientific Subject Areas:
CEAR-07/A Tecnica delle costruzioni (ex SSD ICAR/09)

CEAR-10/A, Disegno (ex SSD ICAR/17)

ISI WEB categories:
- Urban Studies;

- Education & Educational Research;
- Architecture;
- Communication;
- Information Technology & Communication Systems;
- Engineering, Civil.

ERC categories:
PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics
SH2_12 GIS, spatial analysis; big data in political, geographical and legal studies;
SH3_12 Communication and information, networks, media;
SH5_4 Visual and performing arts, film, design;
SH5_6 History of art and architecture, arts-based research;
SH5_12 Computational modelling and digitisation in the cultural sphere;
SH6_3 General archaeology, archaeometry, landscape archaeology.

Keywords:
Cultural Heritage; Knowledge; Punctual survey; Digital survey; Aerial survey; Structural survey; Reality-based; Digital and/or physical modelling; Non-destructive testing; Structural monitoring; Ambient vibration tests; Dynamic identification.