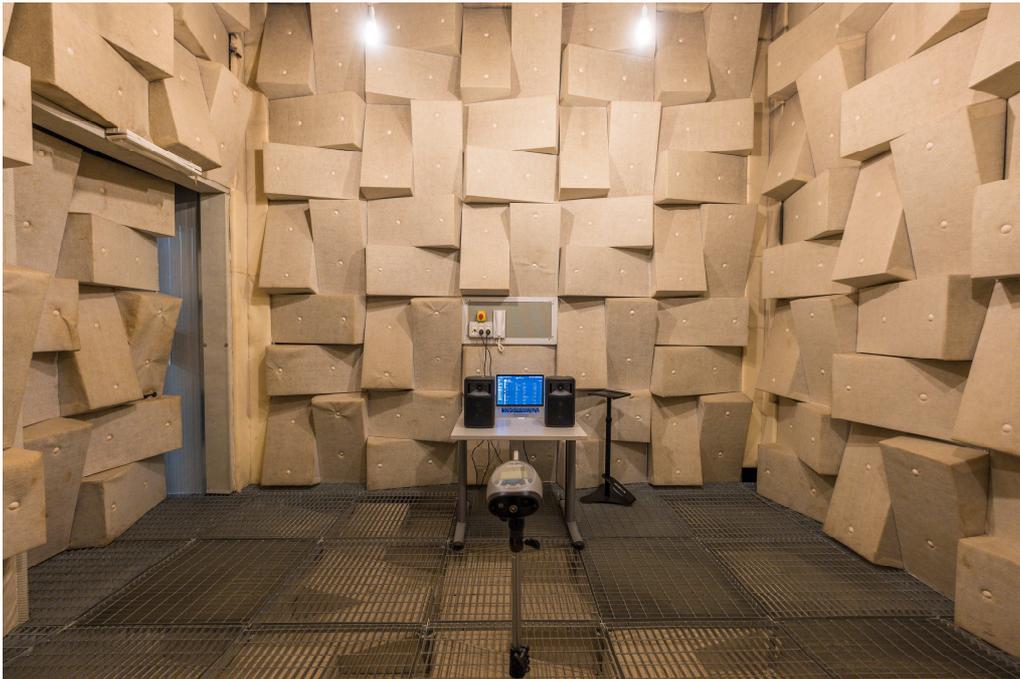


Laboratories RIAS Built Environment Control Laboratory

Principal Investigator: Prof. Luigi MAFFEI
Responsible for teaching and research activities in the laboratory (R.a.d.o.r.): Prof. Luigi MAFFEI (prot. 12026 del 27/02/2015)
Location: The RIAS Lab is located in the Municipality of Frignano, in Via I Maggio, a few kilometres from the Abbey of S. Lorenzo ad Septimum, home of the Department of Architecture and Industrial Design.
Main Laboratory Activities: The RIAS Built Environment Control Lab was founded from the technical-scientific synergy of professors and researchers of the Department of Architecture and Industrial Design of the University of Studies of Campania “Luigi Vanvitelli”. It carries out teaching support activities, experimental studies and scientific research. It provides services to other universities, local authorities, research institutions and Industries, through tests and experiments in the lab, in situ activities and simulation analyses. It includes the following 4 main sectors: <ol style="list-style-type: none">1. Acoustics and Vibrations;2. Energy and Lighting;3. Surveying, Representation and Communication of Architecture and the Environment;4. Structures. <u>Acoustics and Vibrations Sector:</u> The “Acoustics and Vibrations” sector mainly carries out theoretical, computational, experimental and design activities in the field of acoustics and vibrations. In particular, it deals with the measurement, analysis, numerical modelling and evaluation of vibro-acoustic problems in the environmental, architectural, construction, industrial and material fields, both in a traditional way and through the development and application of new multisensory human centred design methods in real or virtual controlled environments. The main activities can be summarized as follows: <ul style="list-style-type: none">- acoustic mapping and acoustic/vibrational monitoring;- forecast assessment of the environmental impact of infrastructures and plants;- assessment of exposure to noise and vibrations in the professional environment;- development and characterization of eco-compatible materials for sound absorption, sound insulation and vibration damping;

- applications of innovative methodologies to support acoustic impact studies and urban acoustic design;
- acoustic analysis and simulation of speech and music environments;
- acoustic analysis and simulation of ancient Greek-Roman theatres and historical opera houses;
- monitoring, analysis and simulation of the soundscape of quiet areas;
- evaluation of product Sound Quality;
- artificial intelligence (AI) and Noise Vibration and Harshness (NVH) applications for product end of line fault diagnosis in industry.



Energy and Lighting Sector:

The “Energy and Lighting” sector is able to offer research and training activities in the theoretical analysis, simulation, experimentation and design in the field of energy efficiency of buildings, renewable sources and polygeneration plants as well as natural and artificial lighting. In particular, the experimental and dynamic analysis systems of domestic cogeneration systems, absorption and electric refrigeration machines, gas heat pumps (GHP), natural and artificial lighting systems for confined

spaces, smart windows, double-skin facades, design of LED lighting fixtures and prototyping by means of 3D printer.

The main activities can be summarized as follows:

- experimental analysis and dynamic simulation of smart windows, with particular reference to electrically controlled glasses;
- experimental analysis and/or dynamic simulation of micro-cogeneration systems, electric chillers, small absorption units, bivalent gas heat pumps and related components;
- dynamic simulation of solar district heating and cooling systems based on the utilization of borehole thermal storages serving small/micro-scale typical Italian districts by means of the dynamic simulation software TRNSYS upon varying the boundary conditions;
- development and application of a methodology for the Fault analysis, fault detection and fault identification of heating, ventilation and air-conditioning plants. The methodology is based on the comparison between the on-site experimental behavior of the systems and the performance predicted by mathematical models developed through Artificial Intelligence techniques and/or dynamic simulation software.



Survey, Representation and Communication Sector of Architecture and the Environment:

The activities carried out in the field of “Survey, Representation and Communication of Architecture and the Environment” are functional to the knowledge, multi-scale and multidimensional, material and immaterial, of architecture, industrial design, the city, the landscape, the environment both in terms of survey and representation of data, and design of visual and/or multimedia communication systems for the organization of data acquired in a technical, educational and informative environment. In particular, disciplinary skills, moving from the awareness of scientific sources and cultural trends

regarding the innovation of ways and techniques of knowledge and representation, can be summarized both in relation to studies on historical and contemporary heritage:

- graphic analysis of architecture, city, environment, object;
- multidimensional survey of architecture, city, environment, object;
- representation of architectural, urban, environmental and object data;
- management and visualization of databases;
- design of graphic and multimedia environments.

Structures Sector:

The sector is able to offer research and training activities in numerical analysis, experimentation and design in the field of seismic safety, structural adjustment, consolidation and static restoration of artefacts and infrastructures. In particular, it deals with the design, processing and experimental verification of the most appropriate solutions, and/or targeted research actions, using the results obtained through specific laboratory equipment.

The main activities can be summarized as follows:

- theoretical and experimental behaviour of masonry structures;
- experimental behaviour and damage to reinforced concrete structures;
- analysis of steel structures and seismic protection techniques of structures through metal devices;
- analysis of wooden structures;
- survey and vulnerability of cultural assets (churches, large statues, archaeological sites);
- testing of isolation devices at the base;
- evaluation of the deterioration of the structures;
- materials and techniques for the consolidation of structures.

Main Equipment:

Acoustics and Vibration Sector

- Anechoic chamber 5m x 5m x 5m;
- Analyzer sound level meters SOLO + calibrators CAL01;
- Acoustic outdoor monitoring systems SCS S003;
- Long term acoustic monitoring system WEB oriented Opera;
- Multichannel card: Symphonie (2ch); Sqobold Head Acoustic (2ch); NI USB 4432 (4ch);
- Audio recorders: ZOOM H6 (6ch); Microtrack II;
- Mannequin Mk1 Cortex;
- Binaural headphones BHS II Head Acoustic;
- Microphone Soundfield SP200;
- Directional microphone Røde NTG 2;
- Sound reproduction systems: MOTU 828 Mk3 Hybrid Firewire; db Opera 415; db Active Speakers; Monitors Dynaudio - Bm5a Mk2; Sub Dynaudio BM9S; Omni Pecker Sound;
- Kundt tube (Impedance) ISO/ASTM. SCS 9020B. Measurement of the absorption coefficient, reflection, impedance Z_s , admittance. $D = 100\text{mm}$ (60-1200 Hz) e 45 mm (80-4000 Hz);
- System for determining the elastic modulus and damping SCS 9021. Oberst Method;
- System for the determination of the damping factor SCS 9022. SAE method;
- System for determining the flow resistance of porous materials (ISO standard) SCS 9023;
- Dosimeter Wed 007 01dB;

- Whole body accelerometer. Whole Body Vibration Set AP5211;
- Hand / Arm accelerometer. Hand/Arm Adapter Set AP5221/3;
- Intensimetric Probe Probe 50AI 31334 + Intensity Calibrator;
- Impact noise generator;
- Labat clinical audiometer;
- Acquisition and analysis software: NI developer Suite; NI Sound and Vibration Toolkit;
- ARTEMIS Suite 7.3; dB ENV; dB Bati; dBFA Suite; dB Sonic; MATLAB 2018; OriginLAB;
- Modeling software and acoustic forecasting: SOUNDPLAN; ODEON;
- WorldViz Vizard Virtual Reality Software;
- Viewers for Virtual Reality: Oculus Rift; eMagin Z800;
- Motion tracking system: Polhemus Patriot 6 gdl, kinect.

Energy and Lighting Sector:

- 2 Twin Cell Tests for thermal, visual and acoustic characterization of smart windows and double-skin façade systems in real scale;
- Darkroom for photometric characterization of small lighting devices Artificial sky capable of reproducing the CIE "overcast sky";
- Heliodon for analysis of carried shadows;
- Heat Flow;
- Thermal Imaging Camera;
- Digital thermo-hygrometer with datalogger;
- Multifunction thermo-anemometer with datalogger;
- Combustion analyzer;
- Luminance;
- Multi-head Luxmeter;
- Video-photometer;
- Spectroradiometer;
- Spectrophotometer;
- Color meter;
- Microclimatic station for solar radiation detection and meteorological conditions Sensors ind speed sensor, Wind direction sensor, Barometer, Thermo-hygrometer, Pyranometer, Hot wire anemometer);
- Modeling and energy analysis software: TRNSYS 18, TerMus;
- Modeling software and lighting analysis: RADIANCE, DaySIM, DIALux;
- 3D printer DA VINCI SUPER.

Complex Representation Area of the Territory and Environment Sector:

- Digital aero-photogrammetric camera LEICA ADS40;
- Sensor LIDAR LEICA ALS50II;
- Hyperspectral and thermal sensors ITRES CASI 1500 e TABI 320;
- SLAR Terma sensor;
- Trimble GPS station5700RTK;
- Trimble Space StationVX;
- Laser Scanner Sensor3D RADAR Z+F Imager 5006h;
- Laser Scanner Sensor 3D TOF Trimble GX;

- Laser Scanner 3D CAM2 Platinum FaroArm;
- Thermal Imaging Camera FLIR SC3000;
- Reson multibeam sensor Seabat 8125;
- Nautec Persian ROV underwater;
- Sonardyne Scout USBL;
- Sub-bottom profiler Innomar SES2000.

Structures Sector:

- Machine for static/dynamic tests on structural elements and seismic isolation devices;
- Universal machine for tensile or compression tests, monotone and cyclic, on specimens;
- Machine for compression tests on samples/specimens in different material;
- System for sonic and ultrasonic investigations;
- SPR multi-frequency geo-radar system, geo-radar system for the acquisition of high-resolution 3D images;
- High precision digital pacometer;
- Concrete hammer for concrete structures;
- Instrumentation for corrosion analysis;
- Station for tests with flat jacks on masonry structures;
- Digital video-endoscope;
- High resolution and high sensitivity thermographic systems;
- Units and sensors for displacement and acceleration measurements.

The list includes some equipment purchased with funds constituting CRdC Benecon, Regional Competence Center for Cultural Ecology Economy, located at the same site as the RIAS Laboratory.

Associated Research Groups

- Acoustics, Vibration and Multisensory Interactions;
- Energy Efficiency & Environment;
- Drawing, Survey, Representation, Structure, Communication of cultural heritage;
- RESilience of Structures.

Reference Scientific Subject Areas:

ING-IND/11; ING-IND/10; ICAR/17; ICAR/08; ICAR/09.

ISI WEB categories:

- Computer Science, Software Engineering;
- Engineering, Environmental;
- Engineering, Multidisciplinary;
- Acoustics;
- Physics, Multidisciplinary;
- Engineering, Manufacturing;
- Public, Environmental & Occupational Health;
- Computer Science, Artificial Intelligence;
- Computer Science, Hardware & Architecture;

- Urban Studies;
- Education & Educational Research
- Architecture
- Communication
- Construction & Building Technology
- Engineering, Civil
- Engineering, Mechanical
- Engineering, Multidisciplinary
- Humanities, Multidisciplinary
- Materials Science, Characterization & Testing
- Materials Science, Composites

ERC categories:

- PE2_12 - Acoustics
- PE2_14 - Thermodynamics
- PE6_1 - Computer architecture, pervasive computing, ubiquitous computing;
- PE6_9 - Human computer interaction and interface, visualization and natural language processing
- PE6_12 - Scientific computing, simulation and modelling tools
- PE7_3 - Simulation engineering and modelling;
- PE8_6 - Energy systems (production, distribution, application)
- PE8_12 - Sustainable design (for recycling, for environment, eco-design)
- PE8_6 - Energy systems (production, distribution, application);
- PE6_12 Scientific computing, simulation and modelling tools.
- PE8_3 Civil engineering, architecture, maritime/hydraulic engineering, geotechnics, waste treatment
- PE8_11 Sustainable design (for recycling, for environment, eco-design)
- SH3_12 Communication and information, networks, media
- SH3_1 - Environment, resources and sustainability
- SH3_9 - Spatial development and architecture, land use, regional planning
- SH5_4 Visual and performing arts, film, design
- SH5_6 History of art and architecture, arts-based research
- SH5_7 Museums, exhibitions, conservation and restoration
- SH5_8 Cultural studies, cultural identities and memories, cultural heritage

Key words:

Acoustic, psychoacoustic, Multisensory Design; Environmental Impact Assessment; Environment; Psychoacoustics; Lighting; Comfort; Product sound quality; Architecture; Sustainability; Urban Studies; Buildings, solar energy, district heating and cooling, seasonal thermal energy storage, TRNSYS, fault analysis, smart façades, smart window, daylighting, LED, airborne monitoring techniques, visual communication, monumental buildings, media experience, graphics, GIS / Geographic Information System, H-BIM / Heritage Building Information Modelling, masonry structures, architectural and environmental drawing, remote sensing, architectural survey.

Laboratory certifications:
UNI EN ISO 9001: 2015

Sector:
IAF 35-34

First certification:
24 may 2007

Last certification:
Certificate n. 374aSGQ07 of the 29 may 2019

Field of application:
Multidisciplinary design and services for technical advice, research and teaching support to manage and control the built environment.

