

Curriculum vitae di Alfredo Giacomo Cigada

Sottosettori ERC primari, *PE8_14 (Automotive and Rail)* *PE8_10 (Manufacturing engineering)*
PE7_8 (Sensor Networks)

Eventuali sottosettori ERC secondari: *PE8_3 (Civil)*, *PE8_11 (Environmental)*; *PE8_7 (Mechanics)*

PERSONAL DETAILS

Family name: Cigada First name: Alfredo Giacomo

Birthdate: 1965 April 26th

Researcher unique identifier(s): ORCID: <https://orcid.org/0000-0001-6861-8374>

URL for web site:

<https://www.mecc.polimi.it/it/personale/alfredo.cigada;>

Bibliometric indexes (April 10th 2026)

Google scholar: h-index =36 #publications =374 #citations = 4409

Scopus: h-index = 32 #publications =221 #citations = 3207

WOS: h-index= 38 #publications=259 #citations = 4916

• Education and key qualifications

06/07/1994 PhD in Applied Mechanics

Department of Mechanical Engineering, Politecnico di Milano, Italy

Supervisor: Prof Giorgio Diana, Prof Marzio Falco

Title: “Prove in galleria del vento su modello completo di un ponte sospeso per definirne il comportamento aeroelastico: problemi connessi con la sperimentazione e confronto con risultati analitici”

• Current position(s)

2002 – present: Professor: Mechanical and Thermal Measurements

School of Industrial and Information Engineering and School of Civil, Environmental and Land Management Engineering; Dept. Mechanical Engineering, Politecnico di Milano, Milano, Italy

2003 – 2008: Professor: Mechanical and Thermal Measurements

School of Engineering, Dept. Civil Engineering and Hydraulics, University of Pavia, Pavia, Italy

• Previous position(s)

1985- 1986 Military Service

Corps of Engineers, Italian Ministry of Defense

2004 – 2010 Board of Directors

Politecnico di Milano, Italy

2019 -2020 Visiting Researcher

University of Miami, USA

1989 – 1990 Visiting researcher

Danish Maritime Institute Denmark

1990 – 1994 PhD in Applied Mechanics

Politecnico di Milano, Milano, Italy

2022 – 2025 Chair: National Group of Mechanical and Thermal Measurements, Italian Ministry of University and research

RESEARCH ACHIEVEMENTS AND PEER RECOGNITION

Research achievements

- The activity in Mechanical Measurements has offered the chance to have strong transverse skills in different areas. Papers belong to the following topics:
 - **Fluid Structure interaction:** both air and water, new measurement techniques and instrumentation for field testing;
 - **Vehicle sub-structure interaction:** vibrations produced by high-speed and subway trains, measurement methods for rail short pitch corrugation and wheel-rail contact forces, continuous monitoring of subways;

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- **Cable vibrations:** pantograph catenary interaction, overhead transmission line vibrations, with new recorders for measurements on powered lines, damper optimization (power lines and London Eye cables), dynamics of submarine cables and vortex shedding suppression devices.
- **Electro-mechanical interaction** on both train and submarine engines;
- **Image processing:** motion measurement through cameras, thermography;
- **Fiber optic sensing and MEMS sensor nodes** in the development of large networks;
- **Acoustics:** noise measurements and control; beamforming;
- **Structural health monitoring, vibration protection and big data management** for: stadia, bridges, skyscrapers and cultural heritage
- **Safety, security and medicine:** border protection, crime fighting, support to legal medicine and surgery, new measurement techniques for human health.
- **Renewable energy:** energy from marine currents: wind turbine structural integrity
- Founder of the following **SPIN-OFF** or **START-UP** companies:
 - **Innovative Security Solutions:** based on 3D vision systems, working on face recognition first (cooperation with Legal Medicine, University of Milano, Prof Cristina Cattaneo), then on bin picking applications. Awards: Lombardia Start Cup 2005 (best business plan - first prize); Call Artemide, Regione Lombardia, for projects on advanced manufacturing (2009 – first prize); the main product 3DCPS has been awarded by the journal Vision System Design: Innovators Awards - Gold level honorees (2015)
 - **Sacertis:** a start-up company generated by ST Microelectronics and a group of selected academics; the company offers systems and services for continuous real-time monitoring of the structural behavior of civil works and infrastructures; at present the company has taken care of more than 150 structures
 - **KnowCE:** a company based on the expertise of many high-level professionals all over Europe, and companies like IBM, Sund und Baelt, Abertis; the aim is to integrate inspection images, mathematical models, sensor and design data into deep engineering analytics, to assess a structure condition and prioritize lifecycle management actions by the use of images and AI.
 - **IoTSafe:** a company born inside the Dalmine business incubator (Bergamo) with the main aim to discover solutions to enable continuous remote monitoring and real-time diagnostics of lifts and escalators.

In the following, a selection of the most recent and important funded **PROJECTS** is given:

- EU funded project **DIAMOND** “Decentralized critical Infrastructure Asset Monitoring and coNDition assessment”. Supported by MSCA programme, the project trains young researchers to develop decentralised, AI-driven monitoring tools. This includes smart sensors, data analysis, and sustainable power harvesting Grant agreement ID: 101227338, funding € 4 034 254.32
- EU funded project **OMO-Rail**: “On-Board Monitoring of In-Service Trains for the Structural Health Monitoring of Railway Bridges” (2024-2027) MSCA-PF action; beneficiary: Charikleia Stoura; joint research Politecnico di Milano - ETH Zurich; the project works to detect railway bridge health from measurements on board travelling trains; Grant agreement ID: 101104968 funding € 297 164.16
- EU funded project **FLEXHYON** “Flexible hybrid electrical systems for sustainable process intensification on-demand and where required” (2025-2028) – Horizon Europe. The project aims at substituting energy intensive processes, like industrial heating or drying, with approaches having lower emissions and energy consumption; Grant agreement ID: 101192990 (Coordinator Prof Chiariotti) funding € 5 247 799.2
- EU funded project **IM- SAFE** “Harmonised Transport Infrastructure Monitoring in Europe for Optimal Maintenance and Safety” (2020-2023) H2020 NMBP TO IND 2018-2020 CSA EU 2.1.3 and 2.1.5; the project was meant to pave the way to a new Eurocode on Structural Monitoring: I served as the Italian scientific representative, bringing in field expertise and scientific knowledge funding € 1 999 978.75
- Project: “**Technology for the Museums of Basilicata** - TECH4MUBAS PON "Cultura e Sviluppo" FESR 2014- 2020 Progetto ISCR “Capolavori in 100 Km, un viaggio reale e virtuale nella cultura della Basilicata, per conoscere, conservare, valorizzare” Innovation partnership to develop new services for transportation and exposition of art manufactures in the Basilicata Museums. The project was asked to develop new approaches for transportation and management of museum artworks, with a primary goal to reduce vibrations threats. A milestone was to provide a first draft of a white paper for both the transportation of artworks and their protection from seismic shakes in exposition showcases, to be transferred to the Italian Ministry of Cultural Heritage funding funding € 511 000. The project has led to two white papers about the vibration risks for cultural heritage and the design of a new museum showcase insensitive to seismic shakes

In the following the main activities as a **SERVICE TO PUBLIC AND PRIVATE COMPANIES** are given

- **PI for Structural Health Monitoring of the Meazza Stadium in Milano**, 2003-: a wide project on Structural Health Monitoring, crowd structure interaction and risk management for big events, with a strong practical impact on the operation management of critical infrastructures. The project was started as a service to the city of Milano, driving proper maintenance strategies; through the years it switched into an open lab for innovation and testing of new measurement strategies and approaches for Structural Monitoring and stadia dynamics: some solutions have been then transferred to other structures like the Bird's Nest in Beijing, also turning research into tools for security and management of crowds during big events. The group I lead has been working for many major events: hundreds of football matches including a Champion's League final, more than 200 concerts, 2 pope visits, 1 rugby international match and the opening ceremony of the Olympic Games Milano Cortina. This project is gradually changing the approaches and the culture for a safe management of big events, producing huge impacts, in which also engineering plays a crucial role in practice improvement.
- **PI for the Duomo di Milano structural monitoring of the main spire during its restoration** (2012-2016). The big scaffolding adopted for restoration was a complex structure, which was designed not to overload the dome: a continuous monitoring system was needed to generate alarms, in case the external structure got too close to the spire, due to the wind actions; it has been a challenging task, as in the past, the spire never went through such a complete and deep restoration, with the substitution of structural marble parts, in a very harsh environment, due to the exposed height and the risks of lightnings, thunderstorms, strong winds. During restoration some strong seismic shakes (Emilia earthquake 2012) put the monitoring system under pressure to detect the structure health after the two main shakes. I have been responsible for laying down a novel sensor network, in a sensor fusion approach, to manage data in real-time and immediately provide prompt alarms, including activities of awareness of the system for the working people. The project has won some prizes for the innovative solutions in fiber optic sensing and monitoring novel approaches.
- **PI for the supervision and lead of the engineering activities in the project for the protection against vibration threats of Michelangelo's Pietà Rondanini** in the new museum at Castello Sforzesco Milano (2012-2015) and then of **Vittoria Alata** in Capitulum, Brescia (2020-2023). The former project has involved many researchers and companies from Italy (Arteria, Ministry of Cultural Heritage), the US (University of San Diego, Getty Conservation Institute, Miyamoto International) and from Japan (THK) for the design and construction of the new base to protect the famous Michelangelo's masterpiece from vibrations, due to both urban traffic and seismic actions. Later, a continuous monitoring system was designed and deployed, to check the system effectiveness (in service since 2015). The experience gained has led to design a second system for Vittoria Alata, a bronze statue which is now considered the symbol of the city of Brescia.
- **PI for the dynamic testing of Saint Peter's Basilica in Rome** (2023-2024): part of a bigger project driven by Italferr (now FS Engineering), aimed at the digitization of the ancient Basilica. The activity was directed at understanding if such a big complex could have a dynamic behavior, capable of providing information about structural health: results have been positive and a wider project is about to start after the jubilee of 2025.
- **PI for the dynamic testing of Palazzo Lombardia**, then for the design of a **continuous monitoring system**. At the time of its construction this was the highest skyscraper in Italy and a critical infrastructure, hosting the regional government and the civil protection headquarters. The tests also included the helipad and the roof of the main plaza, part of the complex, the biggest covered in Europe. The project is still running, in the hands of some of my past staff members.
- **PI for the dynamic testing for the bridges of the new BreBeMi highway and the bridge over Ticino river** (Milano Torino highway)

Co-inventor of **9 patents, 8 are PCT (international)** and all of them have been **licensed**.

Recent **BOOK CHAPTERS** considered relevant for the scientific profile

- I Alovisi, D. La Mazza, M. Longo, F. Lucà, M. Malavisi, S. Manzoni, D. Melpignano, A. Cigada, P. Darò, G. Mancini "New Sensor Nodes, Cloud, and Data Analytics: Case Studies on Large Scale SHM Systems", Pages 457-484 in "Structural Health Monitoring Based on Data Science Techniques", Ed. A. Cury, D. Ribeiro, F. Ubertini, M. D. Todd, Springer International Publishing, 2022, ISBN 978-3-030-81716-9
- Limongelli, M.P., Manoach, E., Quqa, S., Giordano, P.F., Bhowmik, B., Pakrashi, V., Cigada, A. "Vibration Response-Based Damage Detection" (2021) Springer Aerospace Technology, pp. 133-173. DOI: 10.1007/978-3-030-72192-3_6

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- A. Cigada “The Use of Numerical Modeling to protect old Statues” in “When Galleries Shake: Earthquake damage mitigation for museum collections” Getty Publications (pp 126-130) 2017
- A. Siami, H. R. Karimi, A. Cigada, E. Zappa “Vibration protection of cultural heritage objects” chapter 5 in Vibration Control and Actuation of Large-Scale Systems 2020 Elsevier <https://doi.org/10.1016/B978-0-12-821194-6.00005-6>

Awards and Peer recognition

- Main Invited Talks in the last 10 years, relevant for my research topics
 - “Good measurements for good structural health monitoring” Invited talk, University of Sheffield 21 October 2015
 - “Some present challenges in Structural Health Monitoring: MEMS sensors and measurement systems” Invited talk, University of Southern Denmark, 2018
 - “Sensors: the fundamental brick of every measurement system (The case of Structural Health Monitoring of Civil Structures)” Keynote speech, World Sensors Technological Innovation Summit Zhengzhou China, 2019
 - “Metrology meets Structural Health Monitoring: a long journey through sensors, measurement systems and structures” – Keynote speech, 10th European Workshop on Structural Health Monitoring Palermo 2022
 - A. Cigada “Metrology: an unavoidable aid or an issue for SHM”, Invited Talk, Dewesoft Measurement Conference 2024, Lasko, Slovenia
- Associate Editor: Experimental Techniques (2012-): journal of the Society of Experimental Mechanics (SEM - member since 2005)
- Associate Editor: Sensors (2021-)
- Scientific Board Structural (2013 -): one of the reference journals for Structural Engineering in Italy
- Deputy Director of Tutto Misura (2010-2025) the reference journal for Measurements in Italy
- EU: project evaluator for the European Community in the MSCA-Postdoctoral Fellowship and ERC.
- Peer review for Universities: University of Padova, Department of Mechanical Engineering (2005-2008), University of Rijeka (Croatia) - Faculty of Engineering (2024), then for Croatian Science Foundation, Swiss Science Foundation, board for the selection of new Professors at Princeton University.
- The monitoring of the Duomo di Milano received some awards; we mention the most important: in the section “Achievement awards to recognize the most innovative user applications based on NI software and hardware - Structural and Physical Test and Monitoring, NI Week 2013, Austin (USA)”; the project: “Fiber-Optic Strain Gages Protect Restoration of Milan Cathedral” won the second prize at NI-week, an event hosted by National Instruments. The award recognizes the most innovative user applications based on NI software and hardware worldwide.
- Outstanding Journal Paper Award: Journal of Performance of Constructed Facilities - ASCE for the paper "Dynamic Behavior of the Palazzo Lombardia Tower: Comparison of Numerical Models and Experimental Results" by Alfredo Cigada, Elena Mola, Franco Mola, Gianfranco Stella, and Marcello Vanali (May-June 2014)
- ENR 2016 Global Best Projects: category “Specialty Construction” for the design of the new technological base for Michelangelo's Pietà Rondanini. Engineering News Record (ENR) is an American weekly magazine that provides news, analysis, data and opinions for the construction industry worldwide. It is regarded as one of the construction industry most authoritative publications.
- Aftab Mufti Medal Award, from the International Society for Structural Health Monitoring of Intelligent Infrastructure, for the paper “Scour at river bridge piers: real-time vulnerability assessment through the continuous monitoring of a bridge over the river Po, Italy” September 2019, Vol. 9, Issue 4, pp. 513-528, Alfredo Cigada and Gianluca Crotti. The paper refers to a patent which has been licensed to different companies and, after the first installation over the Borgoforte Bridge (river Po, Mantova), is now part of a bigger project, developed by RFI, for the monitoring of bridge pile scour.
- Best paper award: 10th International Conference on Experimental Vibration Analysis for Civil Engineering Structures - EVACES 10, for the paper "Thermal Effects on Bridge Dynamic Behaviour", by P. Darò, B. De Cicco, D. La Mazza, M. Longo, P. Chiariotti, S. Manzoni, A. Cigada and G. Mancini: it addresses a common problem concerning the interfering effects of temperature on the estimation of parameters to detect damage; for the first time the evaluation is based on a wide amount of data, not just being related to lab testing or a single bridge, which do not allow result generalization.
- The project “Comparative metrological evaluation to measure cumulative damage produced by heavy traffic” was awarded as one of the six winning ideas in the call “Infrastructure Monitoring - Bridges and Exceptional Loads: Call for ideas” by Argo Innovation Lab (Autostrade per l’Italia - MOVYON

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- ELIS Innovation Hub): the contest awarded challenging and breakthrough innovation ideas; the project is based on a challenging sensor fusion approach, trying to substitute weight in motion devices, which are expensive and complex to manage, with cheaper and effective instrumentation.
- Member of the CEI Italian Electrotechnical Committee TC 214, to lay down a new standard for Structural Health Monitoring
- Member of: Society for Experimental Mechanics (SEM), Institute of Electrical and Electronics Engineers (IEEE), International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII), International Association for Bridge Maintenance and Safety (IABMAS); honorary member of Associazione Tecnologi per l'Edilizia (ATE).
- Member of the research group: "Laboratory of Measurements for Biomedical Applications" (LambdaLab) born within the ERC project LaserOptimal, and led by Prof Paola Saccomandi: the lab mainly works on fiber optic and image-based measurements for biomedical applications, along with light-based approaches for minimally invasive therapy and monitoring
- Partner of Labanof: Laboratory of Anthropology and Forensic Odontology - Section of Legal Medicine - Department of Biomedical Sciences for Health - University of Milano, led by Prof Cristina Cattaneo, for an engineering consultancy on problems related to crime fighting, mainly measurements.

ADDITIONAL INFORMATION

Other contributions to the research community

Research has been a wide part of my life since I joined Politecnico di Milano in 1990: the group was very young at that time, and we were only three permanent staff employed in Experimental Techniques. Despite the premature loss of my mentor and supervisor, also leader of the group, today, after 35 years, I lead a research line involving some tens of people (10 permanent staff). Also, thanks to some **foreign mentors**, I **invest** a lot **in young researchers**, this is the reason why the last people joining my group are the youngest winner of an ERC starting grant and a brilliant Professor coming from outside Polimi, very active with EU projects. Another keyword in group management is **cross-knowledge**, made easier by the activity in Measurements: I have worked in many different research areas, merging different cultures and approaches. Examples are the long-lasting cooperation with legal medicine on crime fighting, the recent new research trends on cancer fighting (in cooperation with Istituto Mario Negri), energy intensive process optimization. Working in both wind engineering and hydraulics, close but hardly communicating sectors, requiring strong cross-fertilization with surprising results has been an interesting challenge. Structural monitoring has been another good example, in which the main difficulty consists in the strong need for many different skills, both **practical and theoretical**, for final success: it is a typical example in which the main problem is **bringing science to its everyday use**.

The recent position, as chair of the national group of Mechanical and Thermal Measurements, has further raised my horizons, now directed to new topics related to the measurement of pollution and its effects on humans. My activity in the board of Directors for my University meant a series of precious achievements, as I had to look after research, **intellectual property** and new **spin-off and start-up companies**; this has offered me the chance to open my mind towards a wide and diverse world, trying to help with the **cooperation between Academia and Industry**. I consider my job as an **aid to the community** (not just a service), pushing hard towards the cooperation with **public and private companies and industries**: engineering is an applied science helping to improve the quality of life; this explains the long-lasting co-operation with companies like ST, Pirelli, RFI, Lucchini, and many others, offering important occasions for a professional growth (also in education), as outlined in the previous sections, but also offering the chance to work on something of strong societal impact. Cooperation with public bodies is also quite important in my viewpoint, and I have found interesting empty spaces in a scientific aid for projects like the monitoring of the Meazza Stadium and Palazzo Lombardia: real life and problems are the best bench to test innovation. My group is now known in the world of music and sports management, and we have been asked to measure the crowd actions in different important events: Piazza Sordello in Mantova, the Greek Theatre of Siracusa during concerts. The security check of grandstands during important events is now recognized to the extent of other unavoidable services like the fire department or the ER department, and I consider this a very important achievement. In the cooperation with public bodies, I also found very intriguing the cooperation with the United Nations Industrial Development Organization (UNIDO), where technical skills were strongly required on projects like the exploitation of tidal currents to produce energy (Indonesia, Philippine) or Hospital Waste Management (China), also supporting and helping Italian companies involved in the projects. I confirmed my interest in a mixed diplomatic and technical career while performing my "elder Erasmus" in the United States, in 2020, when I cooperated with our Embassy, Consulate and colleagues, to strengthen relationships with local universities, associations promoting Italy and companies: the kind of project managed in these occasions are of a different kind with respect to those I usually manage, but they strongly require a wide perspective and the capability to merge practical activities with science, focusing on measurable results.