PERSONAL INFORMATION

Michele Ezio Ruggero Maria CARBONI

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Skype: micchettao (Milano, Italy)

Sex Male | Date of birth 31/08/1973 | Nationality Italian

POSITION

Associate Professor in Mechanical Design and Machine Construction at the Department of Mechanical Engineering of Politecnico di Milano, Milano, Italy

WORK EXPERIENCE

October 2014 – today

Associate Professor

ACADEMIC DISCIPLINES LIST: Area 09/A3 - ING-IND/14 “Mechanical design and machine construction”

Politecnico di Milano, Milano, Italy
Department of Mechanical Engineering
Campus Bovisa Sud - via La Masa 1, 20156 Milano
Website: www.mecc.polimi.it

- Lecturing activities at the School of Industrial and Information Engineering (Politecnico di Milano) and at the School of Design (Politecnico di Milano): see Annex “Lecturing Activities”.
- Research activities in the field of structural integrity of mechanical components, non-destructive testing and structural health monitoring: see Annexes “Research Activities” and “List of Scientific Publications”.
- Participation, project manager and/or person in charge within several national and international funded research projects: see Annex “Other Scientific Activities”.
- Participation, project manager and/or person in charge in several research contracts with private companies: see Annexes “Other Scientific Activities”.
- Collaboration with and visiting foreign research centres and universities: see Annex “Other Scientific Activities”.
- Supervision of students (PhD, Master of Science and Bachelor in Mechanical Engineering) and temporary research assistants: see Annex “Other Scientific Activities”.

Business or sector University

January 2005 – October 2014

Assistant Professor

ACADEMIC DISCIPLINES LIST: Area 09/A3 - ING-IND/14 “Mechanical design and machine construction”

Politecnico di Milano, Milano, Italy
Department of Mechanical Engineering
Campus Bovisa Sud - via La Masa 1, 20156 Milano
Website: www.mecc.polimi.it

Business or sector University

May 2002 - January 2005

Postdoctoral Research Fellow

Politecnico di Milano, Milano, Italy
Department of Mechanichal Engineering
Campus Bovisa Sud - via La Masa 1, 20156 Milano
Website: www.mecc.polimi.it

Supervisor: prof. S. Beretta

- Topic: Analysis of the problems related to the strength of materials involved in railway

transports.
Business or sector University

EDUCATION

1999 - 2002 **PhD in Mechanical Behaviour of Materials** EQF level: 8
Università degli Studi di Pisa, Pisa, Italy
Department of Mechanical and Nuclear Engineering
Thesis: “Crack propagation and influence of defects under random fatigue conditions” [In Italian]
Supervisor: prof. S. Beretta (Politecnico di Milano)

1992 - 1998 **Master of Science in Mechanical Engineering** EQF level: 7
Politecnico di Milano, Milano, Italy
Department of Mechanical Engineering
Thesis: “An analysis of the fatigue behaviour of truck wheels” [In Italian]
Supervisors: prof. P. Clerici (Politecnico di Milano), prof. S. Beretta (Politecnico di Milano)

QUALIFICATION AND CERTIFICATION

28/03/2018 **Visual non-destructive testing method in Railway Maintenance**
License #001853-VT-3-C-MF as Level 3 according to ANSFISA Guidelines
Issued by the Italian Institute on Welding
Renewed: 27/03/2023 → License #001853-VT-3-R-MF

28/03/2018 **Visual non-destructive testing method**
License #001853-VT-3-C as Level 3 according to ISO 9712
Issued by the Italian Institute on Welding
Renewed: 27/03/2023 → License #001853-VT-3-R

14/06/2017 **Magnetic particles non-destructive testing method in Railway Maintenance**
License #001853-MT-3-C-MF as Level 3 according to ANSFISA Guidelines
Issued by the Italian Institute on Welding
Renewed: 13/06/2022 → License #001853-MT-3-R-MF

07/06/2016 **Ultrasonic non-destructive testing method in Railway Maintenance**
License #001853-UT-3-C-MF as Level 3 according to ANSFISA Guidelines
Issued by the Italian Institute on Welding
Renewed: 07/06/2021 → License #001853-UT-3-R-MF

06/07/2015 **Laser Safety Officer**
Laser Safety Officer according to EN 60825 and related standards
Issued by the Università degli Studi di Pavia
Renewed: 07/05/2021

28/03/2014 **Ultrasonic non-destructive testing method**
License #001853-UT-3-C as Level 3 according to ISO 9712
Issued by the Italian Institute on Welding
Renewed: 28/03/2019 → License #001853-UT-3-R

22/03/2012 **Liquid penetrants non-destructive testing method**
License #001853-PT-3-C as Level 3 according to ISO 9712

Issued by the Italian Institute on Welding
Renewed: 22/03/2017 → License #001853-PT-3-R
Recertified: 22/03/2022 → License #001853-PT-3-C1

20/10/2011 **Magnetic particles non-destructive testing method**

License #001853-MT-3-C as Level 3 according to ISO 9712
Issued by the Italian Institute on Welding
Renewed: 20/10/2016 → License #001853-MT-3-R
Recertified: 20/10/2021 → License #001853-MT-3-C1

INSITUTIONAL ROLES

2020 → today Appointed Full Member of Academia NDT International

2019 → today Vice President of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)

2019 → today Chair of Working Group 9 on Ethics of the European Federation for Non-Destructive Testing (EFNDT)

2018 → today Elected Member of the Board of Directors of the European Federation for Non-Destructive Testing (EFNDT)

2017 → 2019 Head of the Scientific Council of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)

2016 → 2022 Person in Charge, for the Department of Mechanical Engineering of Politecnico di Milano, of the Internal Double Degree between Civil Engineering and Mechanical Engineering. Two independent and separated Study Programmes have been managed: “Structures” (joining Civil “Structures” track and Mechanical “Advanced Mechanical Design” track) and “Transports” (joining Civil “Infrastructures for Transports” track and Mechanical “Ground Vehicles” track).

2014 → today Elected member of the Board of Directors of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)

2014 → 2016 Invited member at the Board of the Department of Mechanical Engineering (Politecnico di Milano)

2011 → 2014 Delegate of the Assistant Professors of the Department of Mechanical Engineering (Politecnico di Milano) at the Board of the Department.

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Technical skills Mechanical Engineering
Research and Development (R&D)

Mechanical Behaviour of Materials
Laboratory Skills
Mechanical Testing of Materials and Components
Nondestructive Testing (NDT)
Structural Health Monitoring (SHM)
Signal Processing, Data Analysis and Machine Learning
Numerical Simulation and Analysis
Finite Element Analysis (FEA)
University Teaching
Project Planning, Implementation and Management

Computer skills

Systems: DOS, Windows, Linux/Unix
Office suites: Microsoft Office, Open Office, LaTeX
Programming languages: C/C++, FORTRAN, Matlab, Mathematica
CAD: SolidWorks, AutoCAD
FEM: ABAQUS
Dedicated simulation software: NASGRO (fracture mechanics), AFGrow (fracture mechanics), FASTRAN (fracture mechanics), CIVA^{nde} (non-destructive testing), Wave2000 Pro (non-destructive testing)

ADDITIONAL INFORMATION

Memberships

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Academia NDT International
American Society for Non-destructive Testing (ASNT)
American Society for Testing of Materials (ASTM)

Institutional tasks

2014 → today
Fire extinguishing Operator of the Department of Mechanical Engineering (Politecnico di Milano)
2010 → today
First Aid Operator of the Department of Mechanical Engineering (Politecnico di Milano)

ANNEXES

Annex 1 – Lecturing activities
Annex 2 – Research activities
Annex 3 – List of scientific publications
Annex 4 – Other scientific activities

Milano (Italy), 11/02/2023

LECTURING ACTIVITIES

Lecturer

Academic year 2019/2020 – today

FINAL PROJECT WORK (MULTI-DISCIPLINARY PROJECT) (Prova Finale (Progetto Multi-Disciplinare)) – 3 credits

Students: Bachelor in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the laboratory is organized in terms of groups of students (3-5) independently and autonomously developing and finalizing the structural design of an assigned mechanical assembly (gear boxes, washing machines, …). The support given to the students consists in a few focused lectures on theoretical and numerical approaches for the specific case study and in periodical reviews, with the lecturer, about the advancement of the projects.

Academic year 2019/2020 – today

MECHANICAL DESIGN LABORATORY B (Laboratorio di Progettazione Meccanica B) – 4 credits

Students: Bachelor in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the aim of the course is to make the student able to structurally design basic machine elements and simple mechanical assemblies. During the course, components like springs, bearings, bolts, shafts, mechanical couplings, gears and belts are analysed, described and structurally designed. An introduction to the finite element method, as an effective tool for mechanical design, is given, as well.

Academic year 2017/2018 – today

EXPERIMENTAL METHODS FOR STRUCTURAL DIAGNOSTICS (Metodi Sperimentali Per La Diagnostica Strutturale) – 6 credits

Students: Master of Science in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the aim of the Course is to provide the knowledge of Experimental Solid Mechanics, Non-Destructive Testing (NDT) and Structural Health Monitoring (SHM), useful topics for both the design procedures and the structural integrity evaluation of mechanical components and structures during both manufacturing and service. To the aim, the students carry out numerous experimental activities within the Course. The main arguments are:

- the experimental methodologies used to estimate stresses and strains in mechanical components and structures;
- the NDT methodologies useful to evaluate the structural integrity of mechanical components and structures during both the manufacturing and the service stages;
- the SHM methodologies useful to interrogate, in real time, mechanical systems during service and evaluate them for possibly developing damage;
- the analysis of the role of experimental mechanics, NDT and SHM in the design and maintenance stages;
- the design of suitable and effective experiments.

Academic year 2015/2016 – today

MECHANICAL DESIGN AND STRUCTURAL ANALYSIS, CLASS 2 – 3 credits

Students: Master of Science in Design&Engineering

School of Design

Politecnico di Milano

Topics: the course is a module of the final design laboratory in Design&Engineering (total 20 credits) and aims to give support, in terms of lectures on theoretical and numerical approaches and of continuing reviewing, to the structural design of the projects developed by the students. Over the years, projects have been focused on an innovative re-thinking and designing of

common objects like dishwashers, washing machines, refrigerators, three/four wheels electric vehicles, vacuum cleaners, e-bikes and air conditioning systems.

Academic year 2014/2015 – today

MECHANICAL DESIGN AND STRUCTURAL ANALYSIS, CLASS 1 – 3 credits

Students: Master of Science in Design&Engineering

School of Design

Politecnico di Milano

Topics: the course is a module of the final design laboratory in Design&Engineering (total 20 credits) and aims to give support, in terms of lectures on theoretical and numerical approaches and of continuing reviewing, to the structural design of the projects developed by the students. Over the years, projects have been focused on an innovative re-thinking and designing of common objects like dishwashers, washing machines, refrigerators, three/four wheels electric vehicles, vacuum cleaners, e-bikes and air conditioning systems.

Academic year 2014/2015 – 2018/2019

STRUCTURAL ANALYSIS AND DESIGN LABORATORY (MACHINE ELEMENTS AND FEM) (Laboratorio Progettuale di Calcolo Strutturale) – 7 credits

Students: Bachelor in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the aim of the course is to make the student able to design and draw traditional machine elements. During the course, components like springs, bearings, pressure vessels, welds, shafts, press-fits, gears and belts are analysed and described. Some part of the course is also devoted to introduce the finite element method as an effective tool for technical designing. Finally, laboratories on technical drawing of the designed elements are carried out and evaluated.

Academic year 2008/2009 – 2016/2017

EXPERIMENTAL STRESS ANALYSIS AND NON DESTRUCTIVE TESTING (Meccanica Sperimentale e Controlli non Distruttivi) – 6 credits

Students: Master of Science in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the aim of the course is to provide the student with the knowledge of Experimental Mechanics and Non-Destructive Testing (NDT), useful topics for both the design procedures and the structural integrity evaluation of mechanical components and structures. Keeping into account that some topics are partially described in other courses, the main arguments are:

- the main experimental methodologies used to estimate stresses and strains in mechanical components and structures;
- the main NDT methodologies useful to evaluate the structural integrity of mechanical components and structures during both the manufacturing and the service stages;
- the analysis of the role of experimental mechanics and NDT during the design and maintenance stages;
- the design of suitable and effective experiments.

Academic year 2008/2009 – Academic year 2013/2014

STRUCTURAL ANALYSIS AND DESIGN LABORATORY (FINITE ELEMENT METHOD) (Laboratorio Progettuale di Calcolo Strutturale) – 7 credits

Students: Bachelor in Mechanical Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the aim of the course is to make the student able to individually carry out the finite element analysis of a given structure and to critically evaluate its results. During the course, modelling techniques are presented together with concepts and notions needed for the correct setting of a structural analysis, but limiting the subject to linear elastic problems. The main finite elements are described indicating the choosing criteria and the numerical techniques to get the

solution. The final part of the course is devoted to the critical analysis of results and to the evaluation techniques of the prepared models.

Academic year 2008/2009 – Academic year 2010/2011

CRITERIA AND EVALUATION CONCEPTS FOR THE PERFORMANCE OF A PROJECT (Criteri e Concetti di Valutazione delle Prestazioni del Progetto) – 3 credits

Students: Master of Science in Design&Engineering

School of Design

Politecnico di Milano

Topics: the course is a module of the final design laboratory in Design&Engineering (total 20 credits) and aims to give support, in terms of lectures on theoretical and numerical approaches and of continuing reviewing, for the structural design of the projects developed by the students. Over the years, the projects have been focused on an innovative re-thinking of common objects like dishwashers, washing machines and refrigerators.

Academic year 2004/2005 – Academic year 2008/2009

SOLID MECHANICS (Meccanica) – 5 credits

Students: Bachelor in Transport Engineering

School of Industrial and Information Engineering

Politecnico di Milano

Topics: the course is a basic introduction to theoretical structural design, strength of materials and static strength criteria. Starting from the definition of forces and moments the following topics are presented to the students: cinematic analysis, equilibrium of bodies and structures, reactions, section forces and moments, calculations of stresses and static strength criteria for ductile and brittle materials.

Assistant Lecturer

Academic year 2005/2006 – Academic year 2007/2008
EXPERIMENTAL STRESS ANALYSIS AND NON DESTRUCTIVE TESTING (Meccanica Sperimentale e Controlli non Distruttivi) – 6 credits
Lecturer: prof. M. Sangirardi
Students: Master of Science in Mechanical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Academic year 2003/2004 – Academic year 2007/2008
MACHINE DESIGN 2 (Costruzione di Macchine 2) – 10 credits
Lecturers: proff. P. Clerici, A. Terranova, S. Sirtori
Students: Master of Science in Mechanical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Academic year 2002/2004 – Academic year 2004/2005
MACHINE ELEMENTS (Progettazione di Componenti Meccanici) – 5 credits
Lecturer: prof. M. Giglio
Students: Bachelor in Mechanical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Academic year 2001/2002 – Academic year 2003/2004
MACHINE DESIGN 1 (Costruzione di Macchine 1) – 5 credits
Lecturer: prof. S. Beretta
Students: Bachelor in Mechanical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Academic year 2001/2002 – Academic year 2003/2004
MACHINE DESIGN (Costruzione di Macchine) – 10 credits
Lecturer: prof. P. Clerici
Students: Master of Science in Nuclear, Biomechanical and Electrical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Academic year 2000/2001 – Academic year 2003/2004

RELIABILITY AND SAFETY OF MECHANICAL SYSTEMS (Affidabilità e Sicurezza dei Sistemi Meccanici) – 10 credits
Lecturer: prof. S. Beretta
Students: Master of Science in Mechanical Engineering
School of Industrial and Information Engineering
Politecnico di Milano

Lecturer in Master Programmes, Professional Lifelong Learning courses, Workshops, Seminars and Study Days

2022
AIM
Times held: 1
Number of hours: 2
Topics: reliability of non-destructive testing

2022
CIFI: “DAL MONITORAGGIO ALLA MANUTENZIONE PREDITTIVA: l’utilizzo dei big data nella manutenzione di sale montate ferroviarie”
Times held: 1
Number of hours: 1
Topics: in-service non-destructive testing and its reliability

2021
AIM
Times held: 1
Number of hours: 2
Topics: mechanical testing of full-scale components

2020
SEMINAR NDT IN RAILWAY
Times held: 1
Number of hours: 0.5
Topics: application of eddy currents non-destructive testing to the estimation of corrosion-fatigue damage in railway axles

2020
NON-DESTRUCTIVE METHODS FOR COMPOSITE MATERIALS
Times held: 1
Number of hours: 2
Topics: non-destructive methods for composite materials

2019
AIM
Times held: 1
Number of hours: 2
Topics: mechanical testing of full-scale components

2019
AIM
Times held: 1
Number of hours: 2
Topics: reliability of non-destructive testing

2019
AIPND: “FORENSIC ENGINEERING AND NDT”
Times held: 1
Number of hours: 1
Topics: NDT and damage evaluation after a fall of “Forme uniche della continuità nello spazio” by Umberto Boccioni

2018
ART & ARCHAEOLOGY 2018
Times held: 1
Number of hours: 1
Topics: a proposal for a multidisciplinary procedure for the evaluation of historical metallic tie-rods

2018
ADDITIVE MANUFACTURING: CHALLENGES AND NEW DEVELOPMENTS
Times held: 1

Number of hours: 2
Topics: Non-destructive evaluation and testing of metal AM

2017
CIFI: “RAILWAY INFRASTRUCTURE: THE STATE-OF-THE-ART”
Times held: 1
Number of hours: 2
Topics: phased array ultrasonic testing for aluminothermic welds of rails

2016
CIFI: “THE SMART AXLE: EVOLUTION OF THE PRODUCT”
Times held: 1
Number of hours: 2
Topics: reliability of in-service non-destructive testing

2015 → 2017
IIS
Times held: 3
Number of hours: 8
Topics: non-destructive methods for adhesive bonded joints

2015
COXA
Times held: 1
Number of hours: 24
Topics: training on non-destructive methods

2015
CMC Sud
Times held: 1
Number of hours: 32
Topics: numerical simulation of non-destructive methods

2014
ATM: “CORPORATE & CONTINUING EDUCATION” COURSE
Times held: 1
Number of hours: 8
Topics: durability of railway bogies, non-destructive methods

2012
PHD SUMMER SCHOOL “METHODS AND TECHNIQUES FOR THE EXPERIMENTAL STRESS ANALYSIS”
Times held: 1
Number of hours: 4
Topics: reflection photoelasticity with experiments

2012
DIAGNOSTICS AND PREVENTION OF BUILDINGS
Times held: 1
Number of hours: 4
Topics: NDT for metallic structures

2008 → 2009
THE PED STANDARD AND THE STRUCTURAL ANALYSIS OF PRESSURE SYSTEMS
Times held: 2
Number of hours: 4
Topics: FEM for pressure systems, effects of wind and earthquakes on structures, design of supports

2008
ENI: “PIPINGS AND LONG-DISTANCE PIPELINES”
Times held: 1
Number of hours: 4
Topics: primary and secondary loads, NDT for piping systems

2007 → 2008
MECHANICAL DESIGN WITH MATERIALS
Times held: 2
Number of hours: 2

Topics: design approaches (safe-life, fail-safe, damage tolerance)

2007
TOSI: “MASTER on TURBOMACHINES”
Times held: 1
Number of hours: 7
Topics: fracture mechanics

2006
TENARIS/DALMINE: “WORKSHOP ON FATIGUE OF MECHANICAL COMPONENTS”
Times held: 1
Number of hours: 7
Topics: fracture mechanics

2004
FITNESS-FOR-PURPOSE OF MECHANICAL COMPONENTS SUBJECTED TO FATIGUE
Times held: 1
Number of hours: 4
Topics: low-cycle fatigue and fracture mechanics

2002 → 2012
FATIGUE ANALYSIS AND DESIGN OF WELDED STRUCTURES
Times held: 11
Number of hours: 4
Topics: Gusab standard, load spectra and damage calculation, fracture mechanics

2001 → today
METHODS FOR FATIGUE DESIGN OF MECHANICAL COMPONENTS
Times held: 17
Number of hours: 1
Topics: damage calculation and fracture mechanics for a case from the automotive field and one from the railways field

1999 → 2000
PIAGGIO: “MODERN METHODOLOGIES FOR IN-SERVICE FATIGUE LIFE PREDICTION OF MECHANICAL COMPONENTS”
Times held: 2
Number of hours: 8
Topics: low-cycle fatigue, fracture mechanics, experimental derivation of load spectra

RESEARCH ACTIVITIES

Structural integrity of mechanical components

- stress analysis of mechanical components
- characterisation of mechanical, fatigue and crack growth behaviours of materials and components
- environmental and technological effects on fatigue and fatigue crack propagation
- defect-tolerant and damage-tolerant design of components
- development of methods for structural reliability and integrity under in-service conditions and loads

Main applications: railway axles and wheels, welded railway bogies, rails, welds, truck wheels, booms for concrete pumping, hydraulic cylinders, hydraulic pumps, rear axle housings.

Funded Projects: PRIN2004 (MIUR, 2004-2005), WIDEM (FP6, 2005-2008), MARAXIL (Regione Lombardia, 2010-2012), WOLAXIM (FP7, 2010-2012), EURAXLES (FP7, 2010-2014), SUSTRAIL (FP7, 2011-2015), RAAI (H2020, 2016-2018), NextGear (H2020, 2019-today)

Main industrial research contracts: ABB, AnsaldoBreda SpA, ATM SpA, Brembo SpA, Danieli & C. Officine Meccaniche SpA, Flowserve SpA, HitachiRail Espana SL, HitachiRail Italy SpA, Italcertifer SpA, ITA Steelgroup SpA, Lucchini RS SpA, MM SpA, Siemens Italia, Tenaris S.A.

Research on and application of non-destructive testing and structural health monitoring methodologies

- characterization of the reliability and the capability of NDT methods by “Probability of Detection” curves
- characterization of “Model-Assisted Probability of Detection” and “Multi-Parameter Probability of Detection” curves
- NDT in the damage-tolerant design approach
- traditional and advanced (phased array, TOFD, EMAT, creeping waves) ultrasonic testing of materials and components
- structural health monitoring by ultrasonic guided waves
- structural health monitoring by acoustic emission
- eddy current testing of corrosion-fatigue phenomena
- characterization of materials and defects by computed micro-tomography

Main applications: homogeneous and heterogeneous welds, laser welds, railway axles, railway bogies, railway sleepers, rails, CFRP laminates and components, adhesive bonded joints, additive manufacturing

Funded Projects: MARAXIL (Regione Lombardia, 2010-2012), WOLAXIM (FP7, 2010-2012), SUSTRAIL (FP7, 2011-2015), EMATWHEEL (Regione Lombardia, 2012-2014), RAAI (H2020, 2016-2018), NextGear (H2020, 2019-today)

Main industrial research contracts: AnsaldoBreda SpA, ATM SpA, Autostrade per l'Italia SpA, Concert Srl, Fabbrica d'Armi Pietro Beretta SpA, GE Avio Srl, HitachiRail Espana SL, HitachiRail Italy SpA, Italcertifer SpA, ITER Organization, Loptex Srl, Lucchini RS SpA, Radici Novacips SpA, RFI SpA, SAIPEM SpA, Spasciani SpA, Tesmec Rail Srl, Titagarh Firema SpA, Trasfor SA

Lap-joining of thin sheets

- design, optimization and mechanical characterization of the clinching process
- design, optimization and mechanical characterization of the ultrasonic spot welding process for light weight alloys
- design, optimization and mechanical characterization of the ultrasonic welding process for polymers
- design, optimization and mechanical characterization of a hybrid joining process (ultrasonic spot welding + adhesive bonding) for light weight alloys
- design of sonotrodes for ultrasonic welding in the Very High Cycle Fatigue regime

Main applications: steels, aluminium alloys, magnesium alloys, polymers, sonotrodes

Projects: HY-LAP (Dept. Mechanical Engineering, 2008-2009)

Main industrial research contracts: Sirius Electric Srl, Vito Rimoldi SpA

Cultural heritage

- structural integrity, NDT and SHM of historical metallic materials, components and constructions
- assessment of the state of conservation of metal works of art by eddy current testing
- computed tomography of ancient biological tissues and jewellery

Main applications: Egyptian mummies, historical metallic tie-rods, metallic statues (“Forme uniche della continuità nello spazio” by U. Boccioni)

Main collaborations: Court of Milano, Museo Egizio (Torino), Veneranda Fabbrica del Duomo (Milano)

LIST OF SCIENTIFIC PUBLICATIONS

Journal papers (ISI/SCOPUS)

1. Carboni M., Bernasconi A. (2022), Acoustic Emission Based Monitoring of Fatigue Damage in CFRP-CFRP Adhesive Bonded Joints, Insight 64(7), 393-397.
2. S. Bruni, P.J. Mistry, M.S. Johnson, A. Bernasconi, M. Carboni, D. Formaggioni, G. Carra, S. Macchiavello, E. Ferrante, I. Kaiser, J. Viñolas, I. Marazzi (2022), A vision for a lightweight railway wheelset of the future, Proc. Instn Mech. Engrs Part F: J. Rail and Rapid Transit, Vol. 236(10), 1179–1197.
3. R.A.A. Lima, F. Migliavacca, L.M. Martulli, M. Carboni, A. Bernasconi (2022), Distributed fibre optic monitoring of mode I fatigue crack propagation in adhesive bonded joints and comparison with digital image correlation, Theoret. Appl. Fract. Mech 121, 1-12, 103501.
4. R.A.A. Lima, M. Drobiazko, A. Bernasconi, M. Carboni (2022), On crack tip localisation in quasi-statically loaded, adhesively bonded double cantilever beam specimens by acoustic emission, Theoret. Appl. Fract. Mech 118, 1-12, 103286.
5. Ballo F., Carboni M., Mastinu G., Previati G. (2022), Wires for spring construction: full scale fatigue experimental tests, Meccanica 57, 213-228.
6. Bernasconi A., Martulli L.M., Carboni M. (2022), Fatigue crack growth analysis in composite bonded joints by back face distributed strain sensing and comparison with X-ray microtomography, Inf. J. Fatigue 154, 1-14, 106526.
7. Di Luch I., Ferrario M., Fumagalli D., Carboni M., Martinelli M. (2021), Coherent Fiber-Optic Sensor for Ultra-Acoustic Crack Emissions, Sensors 21, 1-15, 4674.
8. Lima R.A.A., Perrone R., Carboni M., Bernasconi A. (2021), Experimental analysis of mode I crack propagation in adhesively bonded joints by optical backscatter reflectometry and comparison with digital image correlation, Theoret. Appl. Fract. Mech 116, 1-14, 103117.
9. Carboni M., Crivelli D. (2020), An acoustic emission based structural health monitoring approach to damage development in solid railway axles, Inf. J. Fatigue 139, 1-11, 105753.
10. Bernasconi A., Carboni M., Ribani R. (2020), On the combined use of Digital Image Correlation and Micro Computed Tomography to measure fibre orientation in short fibre reinforced polymers, Comp. Sci. Tech. 195, 1-9, 108182.
11. Carboni M., Collina A., Zappa E. (2020), An acoustic emission-based approach to structural health monitoring of pre-stressed concrete railway sleepers, Insight 62, 280-291.
12. Bellanova M., Carboni M., Felicetti R. (2019), A feasibility analysis on the application of eddy current testing to the detection of the most detrimental defects in historical metallic tie-rods, NDT&E Int 104, 34–41.
13. Gianneo A., Carboni M., Giglio M. (2017), Feasibility study of a multi-parameter probability of detection formulation for a Lamb waves–based structural health monitoring approach to light alloy aeronautical plates, Structural Health Monitoring 16, 225-249.
14. Rolek P., Bruni S., Carboni M. (2016), Condition monitoring of railway axles based on low frequency vibrations, Int. J. Fatigue 86, 88-97.
15. Carboni M., Cantini S. (2016), Advanced ultrasonic “Probability of Detection” curves for designing in-service inspection intervals, Int. J. Fatigue 86, 77-87.
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139. Skorupa M., Machniewicz T., Skorupa A., Carboni M., Beretta S. (2002), Experimental and theoretical investigation of fatigue crack closure in structural steel, Proc. VIII International Fatigue Congress (Fatigue2002), Stockholm, Sweden, 2309-2316.
140. Beretta S., Carboni M., Machniewicz T., Skorupa M. (2002), Correlation between experiments and Strip Yield model results on fatigue crack growth in structural steel, Proc. 14th European Conference of Fracture (ECF14), Krakow, Poland, 225-232.

National (Italian) journal papers

141. Bellanova M., Carboni M., Felicetti R. (2020), Metallic Historical Tie-Rods – Innovation on Diagnostics for Defect Detection [Catene storiche in ferro battuto - Innovazione nella diagnostica per la ricerca di difetti], Structural Magazine 232, 1-16. [In Italian]
142. Gianneo A., Carboni M., Bernasconi A. (2018), Application of X-ray tomography for the control of fiber-reinforced bonded joints | [Applicazione della tomografia a raggi X per il controllo di giunti incollati fibrorinforzati], Italian Journal on Welding 70(3), 381-387. [In Italian]
143. Bellanova M., Carboni M., Felicetti R., Gianneo A. (2015), On flaw detection in historical metallic tie-rods, The Italian Journal on Nondestructive Testing Monitoring Diagnostics 36(4), 49-54. [In Italian]
144. Dinon T., Carboni M. (2013), OInk: an open source P.I.G. between mechatronics and design, Il Progettista Industriale XXXIII(4), 36-42. [In Italian]
145. Cantini S., Beretta S., Carboni M. (2010), NDT inspection intervals design for railway axles, Italian Journal on Welding 3, 327-331. [In Italian]
146. Cantini S., Patelli G., Beretta S., Carboni M. (2008), Inspection intervals of railway axles made of high strength steel: influence of the POD curve, The Italian Journal on Nondestructive Testing Monitoring Diagnostics 29(1), 13-19. [In Italian]
147. Carboni M., Reboa F., Sangirardi M. (2008), Nondestructive testing of rotating shafts, The Italian Journal on Nondestructive Testing Monitoring Diagnostics 29(2), 18-26. [In Italian]
148. Beretta S., Carboni M., Lo Conte A., Palermo E. (2007), Investigation about the atmospheric corrosion of railway axles made of A1N steel, Italian Journal on Railway Engineering 10, 791-800. [In Italian]
149. Annoni M., Carboni M. (2007), Ultrasonic metal welding of thin sheets: analysis and performance, Italian Journal on Metal Sheet 44(11), 118-128. [In Italian]
150. Beretta S., Carboni M., Cerrini A. (2006), Inspection of railway axles: probability of detection and inspection methodologies, Italian Journal on Railway Engineering 9, 687-697. [In Italian]
151. Beretta S., Carboni M., Desimone H., Paravicini E., Poli A (2005), Hydraulic cylinders: influence of defects on fatigue strength, Journal on Oleodynamics-Pneumatics 11/2005, 44-51. [In Italian]
152. Beretta S., Carboni M., Cerrini A. (2005), POD and inspection interval for railway axles, Proc. 12th National Congress of the Italian Association for NDT, Milan, Italy, CD-ROM (8 pages). [In Italian]
153. Beretta S., Carboni M., Cantini S., Ghidini A. (2004), Experiences and experiments for NDT inspection intervals of railway axles, The Italian Journal on Nondestructive Testing Monitoring Diagnostics 25(2), 13-19. [In Italian]
154. Bini R., Carboni M., Cremascoli A., Monno M. (2003), Fatigue behavior of clinched joints, Italian Journal on Metal Sheet 44 40(11), 108-118. [In Italian]

155. Carboni M., Beretta S., Clerici P., Finzi A., Piazza L. (2000), A fatigue design procedure for truck wheels, Journal of the Technical Association of Automobile 53(9/10), 316-326.

Contributions to national (Italian) scientific books

156. Beretta S., Carboni M., Clerici P. (2001), Defect acceptability and in-service life of truck wheels, AIAS Notebook #7: "Fatigue design of transports focused to safety improvement", B. Atzori and G. Michellone Eds., Italian Association for Stress Analysis, 1-11. [In Italian]

National (Italian) conferences

157. Filippini M., Carboni M. (2022), Monitoraggio delle forze di serraggio in collegamenti bullonati mediante tecniche ultrasonore, Proc. 19th National Congress of the Italian Association for NDT, Verona, Italy, PDF (9 pages). [In Italian]
158. Galli S., Limena L., Rossi C., Carboni M. (2022), Ingegnerizzare la ricerca archeologica: tomografia computerizzata sub-millimetrica a raggi x di oggetti in metallo e pietra dura nelle mummie dell'antico Egitto, Proc. 19th National Congress of the Italian Association for NDT, Verona, Italy, PDF (9 pages). [In Italian]
159. Carboni M., Bernasconi A. (2019), Structural Health Monitoring of Adhesive Bonded CFRP-CFRP Joints by Acoustic Emission, Proc. 10th National Days on Welding (GNS10), Genova, Italy, CD-ROM (12 pages). [In Italian]
160. Bellanova M., Carboni M., Felicetti R., Gianneo A. (2017), Detection of critical flaws in historical forged steel beams, Proc. 17th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (9 pages). [In Italian]
161. Carboni M., Boniotti L., Romano S. (2017), Application of x ray micro computed tomography to the evaluation of components obtained by additive manufacturing, Proc. 17th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (9 pages). [In Italian]
162. Gianneo A., Carboni M., Bernasconi A. (2017), Application of x ray micro computed tomography to the inspection of fiber reinforced bonded joints, Proc. 9th National Days on Welding (GNS9), Genova, Italy, CD-ROM (9 pages). [In Italian]
163. Gianneo A., Carboni M., Mueller C., Ronneteg U. (2015), Ultrasonic inspection of copper canisters for spent nuclear waste: structural attenuation and elaboration of POD curves, Proc. 16th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (10 pages). [In Italian]
164. Gianneo A., Carboni M., Giglio M. (2015), Elaboration of multi-parameter POD curves for structural health monitoring by ultrasonic Lamb waves, Proc. 16th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (6 pages). [In Italian]
165. Bellanova M., Carboni M., Felicetti R., Gianneo A. (2015), On flaw detection in historical metallic tie-rods, Proc. 16th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (9 pages). [In Italian]
166. Cantini S., Carboni M. (2015), POD curves for ultrasonic inspections with non maximizable responses and their application to the rotating probe for solid railway axles, Proc. 16th National Congress of the Italian Association for NDT, Milano, Italy, CD-ROM (10 pages). [In Italian]
167. Gianneo A., Carboni M., Giglio M. (2013), Structural monitoring of carbon fibre reinforced composite panels by Lamb waves, Proc. 15th National Congress of the Italian Association for NDT, Trieste, Italy, CD-ROM (9 pages). [In Italian]
168. Carboni M., Cantini S., Gilardoni C. (2013), MAPOD validation of the UT rotating probe for solid railway axles, Proc. 15th National Congress of the Italian Association for NDT, Trieste, Italy, CD-ROM (11 pages). [In Italian]
169. Carboni M., Beretta S., Cantini S., Gilardoni C. (2013), POD for hollow axles inspected by the boreprobe, Proc. 15th National Congress of the Italian Association for NDT, Trieste, Italy, CD-ROM (11 pages). [In Italian]
170. Beretta S., Carboni M., Lo Conte A. (2011), Corrosion-fatigue of railway axles: experimental analysis and modeling, Proc. 14th National Congress of the Italian Association for NDT, Firenze, Italy, CD-ROM (9 pages). [In Italian]
171. Carboni M. (2011), Ultrasonic experiments and numerical simulations for an effective derivation of POD curves for railway axles, Proc. 14th National Congress of the Italian Association for NDT, Firenze, Italy, CD-ROM (9 pages). [In Italian]
172. Carboni M., Patriarca L., Regazzi D. (2009), Experiences in the application of "compression pre-cracking" techniques in crack growth tests, Proc. XX National Congress of the Italian Group on Fracture, Turin, Italy, CD-ROM (10 pages). [In Italian]
173. Carboni M., Beretta S. (2009), A new perspective to the derivation and the characterization of POD curves, Proc. 13th National Congress of the Italian Association for NDT, Rome, Italy, CD-ROM (10 pages). [In Italian]
174. Carboni M., Paraboschi A. (2009), A critical analysis of ultrasonic echoes coming from artificial defects and fatigue cracks, Proc. 13th National Congress of the Italian Association for NDT, Rome, Italy, CD-ROM (9 pages). [In Italian]
175. Carboni M., Sangirardi M. (2007), Ultrasonic simulations for crack sizing, Proc. 12th National Congress of the Italian Association for NDT, Milan, Italy, CD-ROM (10 pages). [In Italian]
176. Annoni M., Carboni M. (2007), Analysis of the formation and the mechanical behavior of the

ultrasonically welded joint, Proc. XIX National Congress of the Italian Group on Fracture, Milan, Italy, CD-ROM (8 pages). [In Italian]

177. Barbieri C., Beretta S., Carboni M. (2007), Modeling of fatigue crack growth in railway axles made of A1N steel, Proc. XIX National Congress of the Italian Group on Fracture, Milan, Italy, CD-ROM (8 pages). [In Italian]
178. Bernasconi A., Carboni M. (2007), Analysis of the fatigue behaviour of partially welded joints made of FeS690, Proc. XIX National Congress of the Italian Group on Fracture, Milan, Italy, CD-ROM (8 pages). [In Italian]
179. Carboni M. (2005), Precision of local compliance measurements for clack closure, Proc. XXXIV National Congress of the Italian Association for Stress Analysis, Milan, Italy, CD-ROM (10 pages). [In Italian]
180. Beretta S., Carboni M., Cerrini A., Johannesson P., Guidetti M.(2005), Analysis and elaboration of load spectra for hydraulic pumps, Proc. XXXIV National Congress of the Italian Association for Stress Analysis, Milan, Italy, CD-ROM (9 pages). [In Italian]
181. Carboni M. (2004), Local compliance experiments and crack closure models, Proc. XVII National Congress of the Italian Group on Fracture, Bologna, Italy, CD-ROM (6 pages). [In Italian]
182. Bini R., Carboni M., Monno M. (2003), Experimental analysis of clinching process, Proc. VI National Conference of the Italian Association for Mechanical Technologies (AITeM) “Enhancing the Science of Manufacturing”, Gaeta, Italy, CD-ROM (10 pages).
183. Carboni M., Beretta S., Clerici P. (2002), The phenomenon of crack closure in crack propagation: experiments and predictive models, Proc. XXXI National Congress of the Italian Association for Stress Analysis, Parma, Italy, CD-ROM (10 pages). [In Italian]
184. Beretta S., Carboni M., Lombardo F. (2002), A cyclic plasticity model for simulating fatigue crack growth, Proc. XVI National Congress of the Italian Group on Fracture, Catania, Italy, CD-ROM (10 pages). [In Italian]
185. Beretta S., Carboni M., Clerici P. (2001), Correlation between experimental analyses and analytical models for crack propagation in a structural steel, Proc. XXX National Congress of the Italian Association for Stress Analysis, Alghero, Italy, CD-ROM (10 pages). [In Italian]

International and national research projects (funded after selective application by peer review)

2019 → 2021

NextGear: NEXT generation methods, concepts and solutions for the design of robust and sustainable running GEAR

Type: European Union's Horizon 2020 research and innovation programme

Duration in months: 24

Funding scheme: H2020-EU.3.4.8.1. (15 partners across Europe)

Total budget of the project: 2.5 M€

Politecnico di Milano's budget in the project: 270 k€

Role in the Project: researcher (1 MM)

2016 → 2018

RAAI: Whole Life Rail Axle Assessment and Improvement Using Ultrasonic Phased Array and Corrosion Inspection Systems

Type: European Union's Horizon 2020 research and innovation programme

Duration in months: 24

Funding scheme: Horizon 2020's SME Instrument (6 partners across Europe)

Total budget of the project: 1.5 M€

Politecnico di Milano's budget in the project: 150 k€

Role in the Project: researcher (2 MM)

2012 → 2014

EMATWHEEL: Development of a system, based on non-contact ultrasonic inspection, for the manual and automatic determination of residual stresses in railway wheels

Type: Regional R&D Project (Regione Lombardia - MIUR, Italy)

Duration in months: 24

Funding scheme: Collaborative Project (3 partners across Regione Lombardia)

Total budget of the project: 1 M€

Politecnico di Milano's budget in the project: 200 k€

Regional contribution to Politecnico di Milano: 100 k€

Role in the Project: project manager, person in charge and researcher (3 MM)

2011 → 2015

SUSTRAIL: The sustainable freight railway: Designing the freight vehicle – track system for higher delivered tonnage with improved availability at reduced cost

Type: European R&D Project (FP7)

Duration in months: 48

Funding scheme: Collaborative Project (29 partners across Europe)

Total budget of the project: 9.4 M€

Politecnico di Milano's budget in the project: 362 k€

EU contribution to Politecnico di Milano: 272 k€

Role in the Project: researcher (2 MM)

2010 → 2014

EURAXLES: Minimizing the Risk of Fatigue Failure of Railway Axles

Type: European R&D Project (FP7)

Duration in months: 36

Funding scheme: Collaborative Project (23 partners across Europe)

Total budget of the project: 4.8 M€

Politecnico di Milano's budget in the project: 309 k€

EU contribution to Politecnico di Milano: 230 k€

Role in the Project: researcher (1 MM)

2010 → 2012

WOLAXIM: Whole Life Rail Axle Assessment and Improvement

Type: European R&D Project (FP7)

Duration in months: 24

Funding scheme: Capacities, Research for SMEs (9 partners across Europe)

Total budget of the project: 1.5 M€

Politecnico di Milano's budget in the project: 36 k€

EU contribution to Politecnico di Milano: 36 k€

Role in the Project: researcher (1 MM)

2010 → 2012

MARAXIL: Manufacturing Railway Axles with Improved Lifetime

Type: Regional R&D Project (Regione Lombardia, Italy)

Duration in months: 18

Funding scheme: International Scientific and Technological Cooperation

International Partner: Fraunhofer Institute for Mechanics of Materials (IWM), Freiburg, Germany

Total budget of the project: 309 k€

Politecnico di Milano's budget in the project: 309 k€

Regional contribution to Politecnico di Milano: 155 k€

Role in the Project: researcher (1 MM)

2008 → 2009

HY-LAP (Hybrid Lap-Joints): mechanical behavior of hybrid lap-joints made of light alloys (aluminum and magnesium)

Type: "Young Researcher Project" funded by the Department of Mechanical Engineering (Politecnico di Milano)

Duration in months: 24

Funding scheme: collaborative project between researchers coming from the fields of machine design, technology and materials

Contribution: 12 k€

Role in the Project: coordinator, person in charge, project manager and researcher (4 MM)

2005 → 2008

WIDEM: Wheelset Integrated Design and Effective Maintenance (www.widem.org)

Type: European R&D Project (FP6)

Duration in months: 36

Funding scheme: Collaborative Project (10 partners across Europe)

EU contribution to Politecnico di Milano: 400 k€

Total EU contribution: 3 M€

Role in the Project: researcher (2 MM)

2004 → 2005

MIUR PRIN04: High capacity trains: wheel-set in-service reliability and impacts on the line durability

Type: National Co-funded Project

Duration in months: 24

Funding scheme: 70% funded by the Italian Ministry for University and Research

Contribution to Politecnico di Milano: 60 k€

Total contribution: 85 k€

Role in the Project: researcher (2 MM)

2001 → 2003

INTERNATIONAL PROTOCOL: Fatigue crack growth under variable amplitude loading in structural steel

Type: International Scientific and Technological Collaboration Protocol between Italy and Poland

Duration in months: 36

Funding scheme: research funds provided by the Italian and Polish Ministries of University and Research

International Partner: Akademia Gòrniczo-Hutnicza, Krakow, Poland

Role in the Project: main researcher (6 MM)

Scientific person in charge of research contracts with private companies and bodies

2022: Brembo (“Static strength and HCF tests on GS660-5 cast iron”)

2022: Brembo (“Static strength and HCF tests on 10.9 steel grade”)

2022: Brembo (“Static strength and HCF tests on 1 mm thick steel sheets”)

2022: Brembo (“Static strength of steel wires”)

2022: Brembo (“HCF tests on 30MnB4 steel grade”)

2022: Brembo (“Residual stress measurement on a steel spring element”)

2022: Raimondi Cranes (“Strain gage measurements on a crane”)

2021: Titagarh Firema (“NDT procedure and inspections for fatigue tested welded bogie frame and loaded crossbeam”)

2021: Brembo (“Fatigue assessment of 30MnB4 steel grade”)

2020: HitachiRail Italy (“NDT procedure and inspections for the HMU railway joint”)

2020: Lucchini RS (“Numerical validation of ultrasonic inspection procedures for railway axles”)

2020: Azienda dei Trasporti Milanesi (“NDT procedure and inspections of the new Underground Line 3 bogie”)

2020: Brembo (“Strain measurements of brake calipers and companion specimens”)

2020: AnsaldoBreda (“Full scale test and NDT inspections of a railway bogie frame”)

2020: Tesmec Rail (“NDT procedure and inspections, by liquid penetrant testing, of railway brakes”)

2020: Hitachi Rail Espana (“Fatigue durability test of a repaired railway bogie”)

2019: Beretta Armi (“NDT of laser welds for metallic tubes”)

2019: Lucchini RS (“Validation activity regarding the calibration and inspection procedures for the ultrasonic inspection of VTG wheelsets”)

2019: Brembo (“Static testing of crimped strands”)

2019: Brembo (“Strain measurements of brake calipers”)

2019: Brembo (“Fatigue assessment of threaded joints”)

2019: SAIPEM (“Fiber Optic Crack Assessment”)

2019: Hitachi Rail Espana (“Full-scale crack propagation test of a railway bogie”)

2019: RFI (“Non-destructive testing and structural health monitoring of rails by conventional ultrasonic testing and ultrasonic guided waves”)

2018: Court of Milano, Italy (“Non-destructive inspections on the bolted rail joint causing the Pioltello derailment”)

2018: Lucchini RS (“Experimental and numerical validation of the ultrasonic phased array probe SAMT-special”)

2018: HitachiRail Italy (“Validation of design calculations for leading and trailing axles adopted in Metro Milano L4”)

2018: HitachiRail Italy (“Ultrasonic inspection procedure for solid state welds in railway bogie frames”)

2018: Brembo (“High temperature characterization of the compressive yield stress of a steel and a Ti alloy”)

2018: Azienda dei Trasporti Milanesi ("Repair and NDT inspection of metro bogies")

2017: Spasciani (“Radiographic analysis of elastomeric gaskets”)

2017: RadiciNovaChips (“X-ray computed micro-tomography of polymeric materials”)

2017: Lucchini RS (“Numerical validation of ultrasonic inspection procedures for railway axles”)

2017: HitachiRail Italy (“Detection of defects in solid state welds of railway bogie frames by ultrasonic testing”)

2017: Brembo (“Reliable definition of a bench test procedure for brake calipers”)

2017: Brembo (“Compression tests on Gs400 cast iron and a brass”)

2017: Brembo (“Static characterization of different spring steels and an aluminum alloy”)

2017: Azienda dei Trasporti Milanesi ("Failure analysis and ultrasonic inspection of rail bolted joints")

2016: Metropolitana Milanese (“Preliminary analysis of the failure of the pipe in via Regolo/Cartagine, Milano, 10/07/2016”)

2016: ITA (“Design and development of a rotating bending test bench for cold drawn wires”)

2016: HitachiRail Italy (“Ultrasonic inspections of a mounted railway wheelset”)

2016: Brembo (“X-ray computed tomography of fatigue tested EN 1706 AC-42100-K-T6 specimens”)

2016: Brembo (“HCF and LCF tests on AlSi7”)

2016: Brembo (“Static strength and HCF tests on AlSi7”)

2015: SMARTMechanical_Company (“Ultrasonic inspections of motorbike wheels”)

2015: ITER Organization (“Structural integrity analysis of cooling system piping (TCWS)”)

2015: Court of Milano, Italy (“Non-destructive inspections on Umberto Boccioni’s Forme uniche della continuità nello spazio”)

2015: HitachiRail Italy (“Characterization of the rotating bending fatigue limit of AISI 5150 steel grade for railway axles”)

2015: Brembo (“Round-robin on fatigue behaviour of AlSi7”)

2015: Brembo (“Compression tests of Gs400 cast iron”)

2015: Brembo (“Compression tests of a calibration spring and two brake pads”)

2015: Brembo (“HCF fatigue tests and tensile tests of EN 1706 AC-42100-K-T6 alloy”)

2015: Brembo (“Failure analysis of fatigue tested AlSi7 specimens”)

2015: Trasfor (“Non-Destructive Inspections (NDI) for the assessment of the integrity of Cu and Al bonded samples“)

2014: GE Avio (“UT measurement of bolt pre-load”)

2014: AnsaldoBreda (“Determination of the most important parameters acting on finite element simulations of railway axles”)

2014: Siemens (“NDT of rails by means of ultrasonic Lamb waves”)

2014: Siemens (“Development of an innovative drop weight test for rails”)

2013: AnsaldoBreda ("Certification of the mechanical design of wheels and axles for the Milano Expo underground")

2013: Autostrade per l’Italia (“NDT of in-service LIEBIG fasteners”)

2012: Firema ("Magnetic NDT inspection of the loaded crossbeam of a railway bogie”)

2012: Loptex ("Feasibility analysis about the detection of exogenous inclusions in cotton wires for clothes")

2011: ABB ("Evaluation of the mechanical performance of pressure vessels repaired by welding")

2011: Azienda dei Trasporti Milanesi ("Verification of the material used to produce railway wheels and of the applied rim press-fit")

2011: Brembo ("Static, HCF and LCF characterization of an aluminum alloy and two cast irons")

2011: Italcertifer ("Support activity to the certification of an ultrasonic system for non-destructive inspection of rails located in Turkey")

2010: Flowserve ("Analysis and optimization of the LAF50 de-heater and definition of a synthetic tool for its design")

2010: IML Impianti ("Structural integrity analysis by ultrasonic testing of a shaft of a lifting system")

2010: Vito Rimoldi ("Failure analysis of an innovative distributor for water-jet cutting")

2008: Brembo ("Fatigue characterisation of aluminium alloys – influence of the microstructure and of the heat treatment")

2007: Sirius Electric ("Failure analysis of sonotrodes for ultrasonic welding of plastics")

Person in charge of experimental laboratories and tests

2015 → today

Technical Person in Charge and Quality Manager (ISO/IEC 17025) of the dynamic test bench for railway axles available at the Department of Mechanical Engineering (Politecnico di Milano).

2014 → today

Member of the Management Committee and Technical Person in Charge of the PoliNDT inter-departmental lab set at Politecnico di Milano and devoted to the research into new methods for monitoring and diagnosing stability, functionality and durability of civil and mechanical engineering components and structures.

2014 → today

Technical Person in Charge and Safety Officer of the AMALA (Advanced Manufacturing Laboratory) inter-departmental lab set at Politecnico di Milano and devoted to the research on technologies for transforming, processing and characterising advanced materials such as special alloys, composite materials and innovative polymers. AMALA Laboratory has allowed an X-ray computed microtomography system for 3D X-ray surveys' acquisition.

2013 → today

Technical Person in Charge and Safety Officer of the Non-Destructive Testing lab at the Department of Mechanical Engineering (Politecnico di Milano).

2013 → 2015

Technical Person in Charge and Quality Manager (ISO9001) of the dynamic test bench for railway axles available at the Department of Mechanical Engineering (Politecnico di Milano).

2008 → today

Person in Charge of the team devoted to both the quality accreditation of all the non-destructive testing activities carried out at the Department of Mechanical Engineering (Politecnico di Milano) according to ISO 9001 and ISO/IEC 17025 standards.

2003 → 2013

Qualified Technician of the dynamic test bench for railway axles available at the Department of Mechanical Engineering (Politecnico di Milano).

Honours and awards

2019: “Best Paper” Award at the 19th International Wheelset Congress (Venezia, Italy) with the paper: “Ultrasonic inspection of solid railway axles by a phased array rotating probe applied to blind holes manufactured at their ends” by Cantini S., Carboni M., Cervello S., Rocchi C., Tonelli L.

2019: “Merit Certificate” at the 4th International Conference on Reliability, Safety and Hazard 2019 (Chennai, India)

2012: “Merit Certificate for Outstanding Contribution” at the 18th World Congress on Non-Destructive Testing (Durban, South Africa)

2011: Young Researcher Prize annually given by the Dept. of Mechanical Engineering for the scientific productivity

2009: Young Researcher Prize annually given by the Dept. of Mechanical Engineering for the scientific productivity

2009: “Best Paper” Award at the 12th International Conference on Fracture (Ottawa, Canada) with the paper: “Design Review of Freight Axles: Achievement of a Million Miles Axles” by S. Beretta, M. Carboni and S. Cervello

2007: Young Researcher Prize annually given by the Dept. of Mechanical Engineering for the scientific productivity

2006: “Capocaccia” Prize annually given by the Italian Association on Stress Analysis for the paper: "Precisione delle misure locali di cedevolezza per la chiusura di cricche" [Precision of local compliance measurements for clack closure] by M. Carboni

2006: Young Researcher Prize annually given by the Dept. of Mechanical Engineering for the scientific productivity

2004: Young Researcher Prize given every two years by the Italian Group on Fracture for the paper: "Local compliance experiments and crack closure models” by M. Carboni

Reviewing activities

2021 → today

Editorial Board Member, Section “Physical Sensors”, of Sensors (international scientific journal by MDPI)

Peer Reviewer of the projects submitted to the Croatian Science Foundation (the national funding agency devoted to promotion and funding of research in Croatia): 1 review since 2012.

International Journal of Fatigue (36 reviews since 2007)

Engineering Fracture Mechanics (33 reviews since 2005)

Fatigue and Fracture of Engineering Materials and Structures (8 reviews since 2008)

Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit (7 reviews since 2010)

Ultrasonics (6 reviews since 2011)

Theoretical and Applied Fracture Mechanics (6 reviews since 2015)

NDT & E International (6 reviews since 2016)

Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science (5 reviews since 2007)

Materials and Design (5 reviews since 2015)

International Journal of Adhesion & Adhesives (4 reviews since 2017)

Journal of Materials Processing Technology (3 reviews since 2009)

Measurement (3 reviews since 2014)

Materials (3 reviews since 2017)

Non-destructive Testing and Evaluation (2 review since 2010)

Applied Mathematics and Computation (2 review since 2011)

International Journal of Microstructure and Materials Properties (2 reviews since 2016)

Sensors (2 reviews since 2016)

Coatings (2 reviews since 2018)

Journal of Composite Materials (2 reviews since 2020)

Insight (1 review since 2013)

IEEE Sensors (1 review since 2014)

Mathematical Problems in Engineering (1 review since 2014)

Engineering Science and Technology: An International Journal (1 review since 2015)

IEEE Transactions on Reliability (1 review since 2015)

Journal of Non-destructive Evaluation (1 review since 2015)

Mechanical Systems and Signal Processing (1 review since 2015)

Composite structures (1 review since 2016)
The Journal of Adhesion (1 review since 2016)
Advanced Modeling and Simulation in Engineering Sciences (1 review since 2017)
IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control (1 review since 2017)
Mathematics and Computers in Simulation (1 review since 2017)
Structural Health Monitoring (1 review since 2020)
Experimental Mechanics (1 review since 2022)
Experimental Techniques (1 review since 2022)
Polymer Composites (1 review since 2022)

Organization of scientific events

Conference: 19th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Type: national
Location: Verona (Italy)
Date: October 19.21 2022
Role: member of the organising committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "Management of the NDT process in the railway field"
Type: national
Location: Milano (Italy)
Date: November 10-11 2021
Role: member of the organising committee

Conference: 18th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Type: national
Location: Milano (Italy)
Date: October 23-25 2019
Role: member of the organising committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "Additive manufacturing and NDT"
Type: national
Location: Torino (Italy)
Date: November 21-22 2018
Role: member of the organising committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "NDT problematics and experiences in the frame of the railway field"
Type: national
Location: Napoli (Italy)
Date: October 25 2018
Role: member of the organising committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "Energy and Territory"
Type: national
Location: Locana (TO) (Italy)
Date: June 28-30 2018
Role: member of the organising committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "Radiations in the industry: safety issues and advanced applications"
Type: national
Location: Milan (Italy)
Date: November 22 2016
Role: local host and member of the organizing committee

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop "NDT in the railway field: problematic, experiences and applications – II edition"
Type: national
Location: Milan (Italy)

Date: November 5 2014
Role: local host and member of the organising committee

ESIS TC24 meeting “Advances in: Axle Durability Analysis and Maintenance”
Type: international
Location: Milan (Italy)
Date: October 1-2 2014
Role: member of the organising committee

Conference: 15th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Type: national
Location: Trieste (Italy)
Date: October 23-26 2013
Role: organisation of the workshop “Railway and maritime transport”

Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD) workshop “NDT in the railway field: problematic, experiences and applications”
Type: national
Location: Florence (Italy)
Date: December 6 2012
Role: member of the organising committee

ESIS TC24 meeting “Improving lifetime and NDT of railway axles”
Type: international
Location: Milan (Italy)
Date: March 30 2012
Role: member of the organising committee

Conference: 14th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Type: national
Location: Florence (Italy)
Date: October 26-28 2011
Role: organisation of the “Fracture Mechanics” session

Conference: 11th International Conference on the Mechanical Behaviour of Materials (ICM11)
Type: international
Location: Milano (Italy)
Date: June 05-09 2011
Role: member of the organising committee

Conference: 13th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Type: national
Location: Roma (Italy)
Date: October 15-17 2009
Role: organisation of the “Structural Integrity” session

Conference: 19th National Congress of the Italian Group on Fracture (IGF19)
Type: national
Location: Milano (Italy)
Date: July 02-04 2007
Role: member of the organising committee

Chairing at scientific conferences

Conference: 19th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Location: Verona (Italy)
Date: October 19-21 2022
Sessions: 1) Discussion Table on NDT Personnel Certification; 2) Composite Materials; 3) Transports

Conference: 35th European and 10th International Conference on Acoustic Emission Testing
Location: Ljubljana (Slovenia)
Date: September 13-16 2022
Session: Material Characterization

Conference: 18th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Location: Milano (Italy)
Date: October 23-25 2019
Session: Transports

Conference: 4th international conference on reliability, safety and hazard 2019
Location: Chennai (India)
Date: January 10-13 2019
Session: FMEA/FMECA

Conference: International Symposium on Structural Health Monitoring and Nondestructive Testing (SHM-NDT 2018)
Location: Saarbruecken (Germany)
Date: October 4-5 2018
Session: Structural Health Monitoring 3

Conference: 12th European Conference on NDT
Location: Gothenburg (Sweden)
Date: June 11-15 2018
Session: NDT reliability 3

Conference: 12th International Conference Art'17
Location: Turin (Italy)
Date: November 22-24 2017
Sessions: 1) Non-destructive Testing in Cultural Heritage 1; 2) Non-destructive Testing in Cultural Heritage 3

Conference: 17th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Location: Milano (Italy)
Date: October 25-27 2017
Session: Transports

Conference: 3rd International Symposium on Fatigue Design and Material Defects
Location: Lecco (Italy)
Date: September 19-22 2017
Session: Experimental Techniques

Conference: 14th International Conference of the Slovenian Society for Non-Destructive Testing
Location: Portorož (Slovenia)
Date: September 4-6 2017
Sessions: 1) Ultrasonic / acoustic emission testing 1; 2) Ultrasonic / acoustic emission testing 2

Conference: 19th World Conference on NDT
Location: Munich (Germany)
Date: June 13-17 2016
Sessions: 1) Railway Rolling Stock; 2) Ultrasonic Phased Array

Conference: 16th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Location: Milano (Italy)
Date: October 21-23 2015
Session: Conservation of cultural heritage

Conference: 6th European-American Workshop on Reliability of NDE
Location: Minneapolis (Minnesota, USA)
Date: July 27-29 2015
Session: Advanced Methods

Conference: Review of Progress in Quantitative Nondestructive Evaluation
Location: Minneapolis (Minnesota, USA)
Date: July 26-31 2015
Session: NDE in the Railway Branch

Conference: 11th European Conference on NDT
Location: Prague (Czech Republic)
Date: October 6-10 2014
Session: NDT in railways

Conference: 15th National Congress of the Italian Society for Non-Destructive Testing Monitoring Diagnostics (AIPnD)
Location: Trieste (Italy)
Date: October 23-26 2013
Session: Railway transports and fracture mechanics

Conference: 12th International Conference of the Slovenian Society for Non-Destructive Testing
Location: Portorož (Slovenia)
Date: September 4-6 2013
Sessions: 1) Electromagnetic Techniques 2; 2) Acoustic Emission Techniques 2; 3) Acoustic Emission Techniques 3

Conference: 11th International Conference on the Mechanical Behaviour of Materials (ICM11)
Location: Lake Como (Italy)
Date: June 5-9 2011
Session: Experimental mechanics

Conference: Ninth International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics (37th ASTM National Symposium on Fatigue and Fracture Mechanics)
Location: Tampa, FL, USA
Date: May 20-22 2009
Session: Application of fracture mechanics / cohesive zone models

Conference: Seventh International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics (36th ASTM National Symposium on Fatigue and Fracture Mechanics)
Location: Vancouver, Canada
Date: November 14-16 2007
Session: Fatigue crack growth

Research periods abroad

2003
Fraunhofer Chalmers Research Center (3 weeks)
Goteborg, Sweden
Contacts: Prof. Jacques DeMarè, Dr. Pär Johannesson
Topic: statistical analysis of in-service random loadings and development of the WAFO Matlab toolbox

2001
Akademia Gòrniczo-Hutnicza (1 month)
Krakow, Poland
Contacts: Prof. M. Skorupa
Topic: development of a novel methodology for the characterisation of the plasticity-induced crack closure based on “local compliance” measurements

2000
Akademia Gòrniczo-Hutnicza (3 months)
Krakow, Poland
Contacts: Prof. M. Skorupa
Topic: fatigue crack growth experiments and characterisation of the “constraint factor” for a structural steel

2000
Akademia Gòrniczo-Hutnicza (2 months)
Krakow, Poland
Contacts: Prof. M. Skorupa
Topic: fatigue crack growth experiments, “local compliance” measurements and application of a novel methodology for the characterisation of the plasticity-induced crack closure

National and international research collaborations

Each collaboration is demonstrated by at least one scientific paper published in international journal or conference (see Annex “List of Scientific Publications”).

Prof. Alessandro Pirondi
Università degli Studi di Parma (Italy)

Cohesive modelling of hybrid lap-joints

Prof. Raghu V. Prakash
Indian Institute of Technology Madras (India)
Fatigue studies on and structural health monitoring of impacted and unimpacted CFRP laminates

Prof. Małgorzata Skorupa
Akademia Gòrniczo-Hutnicza (Poland)
Crack propagation experiments and modelling under random loading fatigue

Prof. Sofia Teixeira de Freitas
TU Delft (The Netherlands)
Structural integrity, non-destructive testing and structural health monitoring of adhesive bonded joints

Prof. Jordi Vinolas
Escuela Politécnica Superior – Universidad Francisco de Vitoria (Spain)
Design of a lightweight composite railway axle

Dr. Andrea Finzi
Gianetti Ruote (Italy)
Structural integrity of truck wheels

Dr. Thomas Heckel
BAM – Federal Institute for Materials Research and Testing (Germany)
Structural integrity and NDT of railway axles

Dr. Pär Johannesson
SP Technical Research Institute of Sweden (Sweden)
Statistical treatment and extrapolation of service load spectra

Dr. Michael Johnson
University of Nottingham (UK)
Design of a lightweight composite railway axle

Dr. Christina Müller
BAM – Federal Institute for Materials Research and Testing (Germany)
Effect of structural attenuation on ultrasonic waves, POD curves

Dr. Ulf Ronneteg
SKB Swedish Nuclear Fuel and Waste Management Co. (Sweden)
Phased array ultrasonic inspection of Copper Canister: Structural Attenuation and POD Formulation

Dr. Uwe Zerbst
BAM – Federal Institute for Materials Research and Testing (Germany)
Structural integrity and NDT of railway axles

Dr. John Rudlin
TWI (UK)
Determination of ultrasonic “Probability of Detection” curves for railway axles

Mr. Stefano Cantini
Lucchini RS (Italy)
Structural integrity of railway axles

Mr. Marco Guidetti
Casappa (Italy)
Structural integrity of hydraulic pumps

Supervision of PhD students and research fellows

Ms. Alessandra Panerai, 38th cycle (2022-today), PhD in Mechanical Engineering, Politecnico di Milano
PhD topic: “Mechanical Behaviour and Structural Health Monitoring of Adhesively Bonded Joints Subjected to Mixed Mode Loading”

Ms. Alessandra Panerai, temporary research fellow from September 2022 to October 2022
Research topic: “Experimental tests for the fatigue characterization of a steel and consequent data processing”

Mr. Mohammad Mehrabi, 36th cycle (2020-today), PhD in Mechanical Engineering, Politecnico di Milano
PhD topic: “Mechanical Behaviour and Structural Health Monitoring of Adhesively Bonded Joints Subjected to Mode II Loading”

Mr. Simone Galli, 35th cycle (2019-today), PhD in Architecture, Built Environment and Construction Engineering, Politecnico di Milano. Co-supervised with Prof. C. Rossi
PhD topic: “Engineering the Archaeological Research: Submillimetric CT Scan of Ancient Egyptian Mummies”

Mr. Roberto Ribani, temporary research fellow on July and August 2019
Research topic: “Development and optimization of an algorithm for the definition of the short fibres orientation tensor in reinforced polymers”

Ms. Rosemere De Araujo Alves Lima, 34th cycle (2018-2022), PhD in Mechanical Engineering, Politecnico di Milano
PhD topic: “Advanced methods for the mechanical characterization of adhesive joints”

Mr. Andrea Grossi, temporary research fellow on June and July 2018
Research topic: “Analysis of structural health monitoring data of carbon fibre composite specimens subjected to fatigue loading”

Dr. Andrea Gianneo, temporary research fellow from February 2016 to September 2017, Politecnico di Milano
Research topic: “Structural Health Monitoring of mechanical components made of metallic alloys and composites materials”

Mr. Is-Hak Can Icoez, temporary research fellow from January 2013 to October 2013, Politecnico di Milano
Research topic: “Experimental measurement of stresses in metallic materials by DIC”

Mr. Andrea Gianneo, 28th cycle (2012-2015), PhD in Mechanical Engineering, Politecnico di Milano
PhD topic: “Non-Destructive Testing and Structural Health Monitoring of mechanical components made of metallic alloys and composite materials”

Mr. Alessandro Corno, temporary research fellow on November 2012
Research topic: “FEM calculation of a gear joint”

Supervision of Bachelor and Master of Science graduating students

Bachelor: 60 students so far

Master of Science: 40 students so far