

Chiara Nardin

Curriculum Vitae

Chair of Risk, Safety &
Uncertainty Quantification
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Short Biography

Structural engineer and MSCA postdoctoral fellow at the Chair of Risk, Safety & Uncertainty Quantification (RSUQ), ETH Zurich, and at the Hazard Mitigation, Structural Dynamics and Control (HMSDC) group, University of Trento. She received her Ph.D. in Modelling and Simulation in 2022 at the University of Trento with a thesis on seismic experimental analyses and surrogate models of multi-component systems in special-risk industrial facilities.

Her research focuses on seismic risk analysis, fragility assessment, uncertainty quantification, surrogate modelling, and machine learning for industrial facilities. She actively participated in the EU H2020 SERA-SPIF project and is currently developing state-dependent fragility frameworks for complex time-dependent industrial systems.

Research Interests

Earthquake Engineering; Structural Dynamics; Seismic Reliability and Risk Analysis; Industrial Facilities; Surrogate Models; Uncertainty Quantification

Education

- 2019–2022 **Ph.D. in Civil Engineering – Modelling and Simulation**, Department of Civil, Environmental and Mechanic Engineering (DICAM), University of Trento, Italy. **Awarded: Doctor Europaeus, 22/12/2022.**
Thesis: *Seismic experimental analyses and surrogate models of multi-component systems in special-risk industrial facilities*. Supervisor: Prof. O.S. Bursi
- 2016–2018 **Diploma (M.Eng) cum laude in Civil Engineering**, Department of Civil, Environmental and Mechanic Engineering (DICAM), University of Trento, Italy. **Awarded: 29/03/2019.**
Thesis: *Evaluation of fragility functions of structural systems for risk analysis based on Markovian processes*. Supervisor: Prof. O.S. Bursi, Prof. M. Broccardo, Prof. N. Tondini
- 2013–2016 **B.Sc. in Civil Engineering**, Department of Civil, Environmental and Mechanic Engineering (DICAM), University of Trento, Italy. **Awarded: 18/09/2016.**
Thesis: *Instability of structures in large deformations: Euler elasticity*. Supervisor: Prof. A. Piccolroaz

Academic Experience

Research

- 2025–today **MSCA Postdoctoral Researcher — ETH Zurich & University of Trento**, Project: *REACTIS: Seismic Risk Reduction and Adaptation for Complex Time-dependent Industrial Systems*..
Advisors: Prof. M. Broccardo, Dr. S. Marelli
- 2024 **Postdoctoral Researcher — University of Trento**, Project: *PREVENT: Development of physics-informed machine learning models for induced seismicity*..
Advisor: Prof. M. Broccardo

2022–2023 **Postdoctoral Researcher** — **University of Trento**, Project: *Development of Markovian transition matrices for coupled industrial structure–process systems under seismic sequences.*
Advisor: Prof. O.S. Bursi

Teaching

- 2025 **Tutor**, *ETH Zurich*. M.Sc. course in Safety, Reliability and Risk Analysis.
Topics: Risk and reliability analysis.
- 2019–2024 **Lecturer**, *University of Trento*. M.Sc. course in Earthquake Engineering and Structural Design.
Topics: Probabilistic Seismic Hazard Analysis (PSHA), Performance Based Earthquake Engineering (PBEE), Fragility Analysis.
- 2016–2018 **Tutor**, *University of Trento*. Analysis I/II for B.Sc. Engineering courses..
Topics: Fundamental mathematics for engineering classes; exercises and tutorial activities.

Thesis Supervision

- 2025 **Federico Ugolini**, “*Modelli di rischio sismico per la zona dell’Alto Garda*”, University of Trento, LM4 - Architectural and Civil Engineering Course.
- 2025 **Mattia Messina**, “*Progetto MAERS: sviluppo di un modello di fragilità per opere di interesse strategico. Il caso studio del municipio di Riva del Garda*”, University of Trento, LM23 - Civil Engineering.
- 2023 **Manuel Brisaghella**, “*Valutazione di funzioni di fragilita’ stato-dipendenti per sottostrutture di impianti industriali soggette a sciame sismico.*”, University of Trento, LM23 - Civil Engineering.
- 2022 **Matteo De Bonis**, “*Analisi di configurazioni di componenti industriali in strutture in acciaio soggette ad azione sismica*”, University of Trento, LM23 - Civil Engineering.
- 2022 **Cvete Pavloski**, “*Valutazione del rischio sismico di costruzioni in muratura esistenti*”, University of Trento, LM23 - Civil Engineering.
- 2021 **Marco Metalli**, “*Analisi di vulnerabilita’ di strutture in muratura in aggregato edilizio*”, University of Trento, LM23 - Civil Engineering.

Publications

Journal Articles

- [J1] Oreste S Bursi, Hazif Liaqat Ali, **Chiara Nardin**, Marco Broccardo, Gianluca Quinci, Fabrizio Paolacci, and Luca Caracoglia. “Fragility Models for Industrial Equipment Subjected to Natural Hazards”. In: *Chemical Engineering Transactions* 116 (2025), pp. 517–522. DOI: <https://doi.org/10.3303/CET25116087>.
- [J2] **Chiara Nardin**, Stefano Marelli, Oreste S Bursi, Bruno Sudret, and Marco Broccardo. “UQ state-dependent framework for seismic fragility assessment of industrial components”. In: *Reliability Engineering & System Safety* (2025), p. 111067. DOI: <https://doi.org/10.1002/eqe.504>.
- [J3] **Chiara Nardin**, Stefano Zorzi, Federica Zonzini, Carlo Costa, and Marco Broccardo. “Bay-Fi: a BAYesian algorithm for main Frequency Identification on extremely under-sampled signals”. In: *Available at SSRN 5863329* (2025). DOI: https://doi.org/10.1007/978-3-031-96114-4_53.
- [J4] Tugberk Guner, **Chiara Nardin**, Oreste S Bursi, Silvano Erlicher, and Alexandre Monteil. “Design standardisation and seismic protection of SMRs through modular metafoundations”. In: *Nuclear Engineering and Design* 426 (2024), p. 113347. DOI: <https://doi.org/10.1002/eqe.504>.

- [J5] Gianluca Quinci, **Chiara Nardin**, Fabrizio Paolacci, and Oreste S Bursi. “Modelling of non-structural components of an industrial multi-storey frame for seismic risk assessment”. In: *Bulletin of Earthquake Engineering* 21.13 (2023), pp. 6065–6089. DOI: <https://doi.org/10.1002/eqe.504>.
- [J6] **Chiara Nardin**. “Seismic experimental analyses and surrogate models of multi-component systems in special-risk industrial facilities”. In: (2022). DOI: <https://doi.org/10.1002/eqe.504>.
- [J7] **Chiara Nardin**, Oreste S Bursi, Fabrizio Paolacci, Alberto Pavese, and Gianluca Quinci. “Experimental performance of a multi-storey braced frame structure with non-structural industrial components subjected to synthetic ground motions”. In: *Earthquake Engineering & Structural Dynamics* 51.9 (2022), pp. 2113–2136. DOI: <https://doi.org/10.1002/eqe.504>.
- [J8] Christoph Butenweg, Oreste S. Bursi, Fabrizio Paolacci, Marko Marinković, Igor Lanese, **Chiara Nardin**, and Gianluca Quinci. “Seismic performance of an industrial multi-storey frame structure with process equipment subjected to shake table testing”. In: *Engineering Structures* 243 (2021). DOI: <https://doi.org/10.1002/eqe.504>.
- [J9] Christoph Butenweg, Igor Lanese, Marko Marinković, **Chiara Nardin**, Fabrizio Paolacci, Gianluca Quinci, Oreste S Bursi, et al. “SPIF Processed Dataset”. In: (2021). DOI: <https://doi.org/10.1002/eqe.504>.
- [J10] Fabrizio Paolacci, Gianluca Quinci, **Chiara Nardin**, Valerio Vezzari, Alessandra Marino, and Mariano Ciucci. “Bolted flange joints equipped with FBG sensors in industrial piping systems subjected to seismic loads”. In: *Journal of Loss Prevention in the Process Industries* 72.104576 (2021). DOI: <https://doi.org/10.1002/eqe.504>.

Conference Proceedings

- [C1] **Chiara Nardin**, Stefano Zorzi, Federica Zonzini, Daniele Zonta, Oreste Salvatore Bursi, and Marco Broccardo. “Bayesian Approach for Main Frequency Identification on Extremely Under-Sampled Signals”. In: *International Conference on Experimental Vibration Analysis for Civil Engineering Structures*. Springer Nature Switzerland Cham. 2025, pp. 515–524.
- [C2] **Chiara Nardin**, Marco Broccardo, Alfio Viganò, Giovanna Laurenzano, and Stefano Parolai. “Risk analysis of the Alto Garda area by means of microzonation and structural characterisation of buildings mapping”. In: *18th World Conference on Earthquake Engineering (WCEE 2024)*. ETH Zurich. 2024.
- [C3] **Chiara Nardin**, Oreste S Bursi, Marco Broccardo, and Stefano Marelli. “State-Dependent Seismic Fragility Functions for Bolted Flange Joints on Special-Risk Industrial Substructures”. In: *Pressure Vessels and Piping Conference*. Vol. 88513. American Society of Mechanical Engineers. 2024, V005T08A010.
- [C4] Christoph Butenweg, Oreste S Bursi, **Chiara Nardin**, Igor Lanese, Alberto Pavese, Marko Marinković, Fabrizio Paolacci, and Gianluca Quinci. “Experimental investigation on the seismic performance of a multi-component system for major-hazard industrial facilities”. In: *Pressure Vessels and Piping Conference*. Vol. 85352. American Society of Mechanical Engineers. 2021, V005T08A016.
- [C5] **Chiara Nardin**, Oreste S Bursi, Fabrizio Paolacci, Gianluca Quinci, Igor Lanese, and Alberto Pavese. “Shake Table Testing for a Multi-Component Prototype Industrial Plant: Input and System Modelling Issues”. In: *Pressure Vessels and Piping Conference*. Vol. 85352. American Society of Mechanical Engineers. 2021, V005T08A017.
- [C6] Christoph Butenweg, Marko Marinković, Alberto Pavese, Igor Lanese, Ernesto Parisi, Benno Hoffmeister, Marius Pinkawa, Christian Vulcu, Oreste Bursi, **Chiara Nardin**, et al. “Seismic performance of multiple-component systems in special risk industrial facilities”. In: *Proceedings of the 17th world conference on earthquake engineering, Sendai, Japan*. 2020.

- [C7] Marko Marinković, Christoph Butenweg, Alberto Pavese, Igor Lanese, Benno Hoffmeister, Marius Pikawa, Christian Vulcu, Oreste Bursi, **Chiara Nardin**, Fabrizio Paolacci, et al. “Investigation of the seismic behaviour of structural and non-structural components in industrial facilities by means of shaking table tests”. In: *SEDIF 2020–2nd International Conference on Seismic Design of Industrial Facilities*. 2020.
- [C8] **Chiara Nardin**, Igor Lanese, Rocco di Filippo, Roberto Endrizzi, Oreste S Bursi, and Fabrizio Paolacci. “Ground Motion Model for Seismic Vulnerability Assessment of Prototype Industrial Plants”. In: *Pressure Vessels and Piping Conference*. Vol. 83891. American Society of Mechanical Engineers. 2020, V009T09A017.

Professional Experience

- (summer) **Civil Engineer Trainee**, *Gruppo Cinque*, Trento.
- 2015 - 2016 Responsibilities: structural design, bill of quantities, and cost estimation.
- (summer) **Internship at Motorola**, Chicago, Illinois, USA.
2011

Honours and Awards

- 2023 **ReLUIS – 20 Years Research Prize.**
Award for creative and outstanding research initiatives in the field of seismic and structural engineering.
- 2019 **APES Summer School Competition – 1st Rank.**
Competition on the design of a SHM system and the development and testing of OMA techniques for steel structures and pedestrian bridges.
- 2019 **Merit Award for Outstanding Graduate Performance.**
- 2017 **Merit Award for Outstanding Graduate Performance.**

Funded Projects

- REACTIS **MSCA Global Postdoctoral Fellowship, Grant No. 10114735, ETH Zürich & UniTn.**
(Principal Investigator) Adapting to the increasing threat of natural hazards is one of today’s most pressing societal challenges. Seismic risk reduction and the adaptation of complex industrial facilities are vital for the EU’s green transition. Yet, existing policies often rely solely on static risk analyses, overlooking temporal and spatial interactions. Supported by the Marie Skłodowska-Curie Actions (MSCA) programme, the REACTIS project will develop an integrated uncertainty quantification-based approach to seismic risk reduction and adaptation. By delving into the stochastic dynamics of industrial facilities under time-variant seismic hazards, REACTIS aims to revolutionise risk analysis. From single-node systems to real-world industrial networks, the project uses spatial statistics and graph theory to map vulnerabilities and formulate adaptive strategies.

- SPIF (Researcher) **EU H2020 SERA Project – Seismic Performance of Multi-component Industrial Facilities.**, *UniTh*.
The acronym of the SPIF project stands for Seismic Performance of Multi-component Systems in Special Risk Industrial Facilities. The project consists of the study and analysis of the seismic performance of industrial archetype systems endowed with process components and their complex coupling interactions. The project involved the full-scale design of the industrial frames equipped with the process components, e.g., flange joints, pipes and tanks, and the execution of a comprehensive experimental campaign by means of shaking table tests at EUCENTRE, Pavia. Multi-fidelity FE models were used to monitor the tests and perform vulnerability and risk analysis for the industry's two most popular structural designs, i.e. braced BF and moment-resisting MRF frames.
- PRIN 2022 (Researcher) **PREVENT: Physics-informed ML for induced seismicity - CUP E53D23004440006**, *UniTh*.
The project aims to develop innovative predictive models for induced seismicity based on physics-informed machine-learning methods. Specifically, the main goals envisage (i) integrating physical principles into Machine Learning-based predictive models to improve predictive capabilities beyond the training data range significantly; (ii) creating a unique framework that combines physical understanding with datasets to enhance the prediction of induced seismic events at various scales.
- SPOKE#9 (Researcher) **PNRR CN1 Digital Twin - CUP E63C22000970007**, *UniTh*.
Within the framework of the National Centre for HPC, Big Data and Quantum Computing funding on the topic of high-performance data simulation, computation and analysis, the SPOKE#9 project envisages the refinement of a computational framework for state-dependent fragility analysis on multi-fidelity FE models of industrial plants. It is based on a combination of real data, acquired from an extensive experimental shake-table test campaign of a prototype industrial steel structure, and the latest advances in uncertainty quantification analysis using metamodeling techniques. The resulting fragility functions populate Markovian transition matrices for risk and resilience analyses.

Skills

- Software SAP2000, Matlab, AutoCAD, OpenSees, Python, Git, Bash
- Operating Systems Windows, Linux
- Languages Italian (native), English (professional), German (conversational)