CATTANEO LAURA
Curriculum Vitae

Born in Cuggiono, (MI), Italy,
on January 5, 1985.

Current Position
Lecturer of Mathematics @ LIUC – Università Carlo Cattaneo, Castellanza.

My additional research interests are: data analytics for Industry 4.0, statistical models and machine learning algorithms, model simulation and digital twin, integration of information through the manufacturing process.

Other relevant projects:

- *Ansaldo Energia - Lighthouse Plant Project*. Partecipation in the OR3 - Production Asset Management – Production Asset Monitoring, Predictive Maintenance and Enhanced Computerized Maintenance Management Systems.
- *Vodafone 5G* - Process optimization, forecasting and predictive maintenance supported by 5G and AI (Artificial Intelligence) technologies: a next generation industry scenario implemented at Industry 4.0 LAB.
- *MADE – Competence Center Industria 4.0* – Development of the "Maintenance 4.0" use case for awareness creation, training and project development about smart maintenance in the Industry 4.0 framework.

Past Experiences

- **February 2020 – January 2021:** *Post-doc research fellow* at Politecnico di Milano, department of Management, Economics and Industrial Engineering.
  Rivoluzione dei sistemi Cyber-Physical system per le PMI europee, nell'ambito del progetto HUBCAP (GA 872698, https://www.hubcap.eu/). HUBCAP aims at developing digital innovation for SMEs using model-based design technology for Cyber-Physical Systems. HUBCAP helps SMEs to adopt digital tools that allow to model, simulate, analyse and visualise products/processes before build them.
- **February 2020- September 2020:** *maternity leave*
- **February 2018 – January 2020:** *Post-doc research fellow* at Politecnico di Milano, department of Management, Economics and Industrial Engineering. *Modelli matematici innovativi per le attività di pianificazione e scheduling nell'ambito del progetto Advanced Cosmetic Manufacturing (AD-Com),* (https://ad-com.net/). The project aims to enchance the productivity of the cosmetic manufacturing through research and innovation development. In particular, the research has developed mathematical and optimization models in order to schedule operations and activities.
- **Dicember 2016 – February 2018:** *Post-doc research fellow* at Politecnico di Milano, department of Management, Economics and Industrial Engineering. *Studio di modelli di simulation lifecycle e attività di dissemination di progetto.* Manutelligence project - Product service design and Manufacturing Intelligence Engineering platform, Horizon2020 (http://www.manutelligence.eu).
- **April 2016 – November 2016:** *maternity leave*

- **November 2015 – April 2016:** *Post-doc research fellow* at Politecnico di Milano, department of Management, Economics and Industrial Engineering. *Studio di modelli di simulation lifecycle e attività di dissemination di progetto.* Manutelligence project - Product service design and Manufacturing Intelligence Engineering platform, Horizon2020 (http://www.manutelligence.eu).
- **October 2014 – July 2015:** *teacher of mathematics and physics* at liceo artistico "Paolo Candiani", Busto Arsizio
- **April 2014 – September 2014**: *maternity leave*
- **January 2014 - April 2014**: *co.co.co* at Politecnico di Milano, department of Mathematics. Development of computational models based on the Immersed Boundary method to study microvascular transport of fluid and mass.
- **February 2013 - May 2013**: *scientific researcher* at University of Pittsburgh, PA, USA.
- **October 2010 -December 2010**: stage as *scientific researcher* at EPFL, Lausanne.

Education

2011-2014 - **PhD in Mathematical Models and Methods in Engineering**. MOX, Politecnico di Milano. *Thesis: FEM for PDEs with unfitted interfaces: application to flow through heterogeneous media and microcirculation.*

2007-2010 **Master of Science in Mathematical Engineering**, Politecnico di Milano. Scientific calculus and mathematical models and methods in fluid dynamics; *Thesis: Computational models for tissue growth*, 110/110.

2004-2007 **Bachelor of Science in Mathematical Engineering**, Politecnico di Milano. *Thesis: Analysis of diffusivity in porous media from images*, 109/110.

2000-2004 Diploma di maturità scientifica, Liceo Scientifico Statale "Arturo Tosi", Busto Arsizio.

Language Skills

Italian: native speaker.

English: listening: Independent user;
Reading: Proficient user;
Spoken interaction: Independent user;
Spoken production: Independent user.

Digital and Computer Skills:

Information processing: Proficient user;
Communication: Proficient user;
Content Creation: Proficient user;
Safety: Independent user;
Problem Solving: Proficient user.

- *Operating Systems*: Windows, Unix, Mac OS.
- *Utilities*: Latex, Word, Excel, PowerPoint, Keynote, Numbers.
- *Programming Languages*: C, C++, Python.
- *Mathematical Software*: Matlab, FreeFem++, Getfem++, R.
- *Other*: Comsol, Ampl, Paraview.

Publications in International Journals

- Negri, E., Pandhare, V., Cattaneo, L., Singh, J., Macchi, M., Lee, J., *Field-synchronized Digital Twin framework for production scheduling with uncertainty*, Journal of Intelligent Manufacturing, 2021, 32(4), pp. 1207–1228.
- Cattaneo, L., Polenghi, A., Macchi, M., *A framework to integrate novelty detection and remaining useful life prediction in Industry 4.0-based manufacturing systems,* International Journal of Computer Integrated Manufacturing, 2021.

- Fumagalli, L., Cattaneo, L., Roda, I., Macchi, M. and Rondi, M., *Data-driven CBM tool for risk-informed decision-making in an electric arc furnace*, The International Journal of Advanced Manufacturing Technology, 1433-3015, 2019.
- Storti, E., Cattaneo, L., Polenghi, A., Fumagalli, L., *Customized Knowledge Discovery in Databases methodology for the Control of Assembly Systems*, Machines, Vol. 6, 2018.
- Notaro, D., Cattaneo, L., Formaggia, L., Scotti, A., Zunino, P., *A Mixed Finite Element Method for Modeling the Fluid Exchange Between Microcirculation and Tissue Interstitium*, Advances in Discretization Methods: Discontinuities, Virtual Elements, Fictitious Domain Methods, Springer International Publishing 2016.
- Cattaneo, L., Zunino, P., *A computational model of drug delivery through microcirculation to compare different tumor treatments*, International Journal for Numerical Methods in Biomedical Engineering, 2014.
- Cattaneo, L., Formaggia, L., Iori, G. F., Scotti, A., Zunino, P., *Stabilized extended finite elements for the approximation of saddle point problems with unfitted interfaces*, Calcolo, pp. 1-30, 2014.
- Cattaneo, L., Zunino, P., *Computational Models for Fluid Exchange between Microcirculation and Tissue Interstitium*, Applied Math Journal Networks Heterogeneous Media, pp. 135 - 159, Vol. 9, Issue 1, March 2014.
- Zunino, P., Cattaneo, L., Colciago, C.M., *An unfitted interface penalty method for the numerical approximation of contrast problems*, Appl. Num. Math., Vol. 61 (2011) No. 10, pp. 1059-1076.

Publications in Conference Proceedings

- Negri, E., Cattaneo, L., Pandhare, V., Macchi, M., Lee, J.**,** *Integrating PHM into production scheduling through a Digital Twin-based framework*, IFAC-PapersOnLine, 2022, 55(19), pp. 31–36.
- Cattaneo, L., Polenghi, A., Macchi, M., Pesenti, V., *On the role of Data Quality in AI-based Prognostics and Health Management*, IFAC-PapersOnLine, 2022, 55(19), pp. 61–66.
- Polenghi, A., Cattaneo, L., Macchi, M., ...Pesenti, V., Borgonovo, A., *Development of an advanced condition-based maintenance system for high-critical industrial fans in a foundry,* IFAC-PapersOnLine, 2022, 55(2), pp. 48–53.
- Polenghi, A., Cattaneo, L., Arena, S., Orrù, P.F., Macchi, M., *Experiential learning of Prognostics and Health Management and its implementation in MATLAB*, Proceedings of the Summer School Francesco Turco, 2021.
- Balbi, M., Cattaneo, L., Nucera, D.D., Macchi, M., *On the relevance of clustering strategies for collaborative prognostics*, IFAC-PapersOnLine, 2021, 54(1), pp. 37–42.
- Polenghi, A., Cattaneo, L., Macchi, M., *A semantic-driven approach for data analytics to support prognostics and health management*, Proceedings of the Summer School Francesco Turco, 2020.
- Barbieri, G., Sanchez-Londoño, D., Cattaneo, L., Fumagalli, L., Romero, D., *A case study for problem-based learning education in fault diagnosis assessment,* IFAC-PapersOnLine, 2020, 53(3), pp. 107–112.
- A. Ardila, F. Martinez, K. Garces, G. Barbieri, D. Sanchez Londono, A. Caielli, L. Cattaneo, L. Fumagalli, *XRepo - Towards an information system for prognostics and health management analysis,* Procedia Manufacturing, Volume 42, 2020, Pages 146-153, 2020.
- E. Negri, H. Davari Ardakani, L. Cattaneo, J. Singh, M. Macchi, J. Lee, *A Digital Twin-based scheduling framework including Equipment Health Index and Genetic Algorithms*, IFAC-PapersOnLine, Volume 52, Issue 10, Pages 43-48, 2019.
- Cattaneo, L., Macchi, M., *A Digital Twin Proof of Concept to Support Machine Prognostics with Low Availability of Run-To-Failure Data*, IFAC-PapersOnLine, Volume 52, Issue 10, Pages 37-42, 2019.
- Pinna, C., Cattaneo, L., Sassanelli, C., Rossi, M., Pestarino, A., Vignati, A., Dell'Era, C., Terzi, S., *Leveraging European SMEs and Start-Ups competitiveness through design,* Proceedings of the Summer School Francesco Turco, 2018-September, pp. 243-249.

- Cattaneo, L., Fumagalli, L., Macchi, M., Negri, E.*, Clarifying Data Analytics Concepts for Industrial Engineering*, 16th IFAC Symposium on Information Control Problems in Manufacturing INCOM 2018: Bergamo, Italy, 11–13 June 2018.
- Pinna, C., Cattaneo, L., Rossi, M., Dell'Era, C., Terzi, S., Pestarino, A., Vignati, A., *Teaching Design in Europe: Challenges and Trends*, 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Stuttgart, 2018.
- Cattaneo, L., Cerri, D., Terzi, S., Wellsandt, S., Thoben, K-D., *Proposal of a methodology for pss lifecycle-oriented design: Application in the automotive industry*, 2017 International Conference on Engineering, Technology and Innovation (ICE/ITMC), pp 865 – 871, IEEE 2017.
- Cattaneo, L., Rossi, M., Negri, E., Powell, D., Terzi, S*., Lean Thinking in the Digital Era*, Product Lifecycle Management and the Industry of the Future. PLM 2017. IFIP Advances in Information and Communication Technology, vol 517, pp 371-381. Springer, Cham.
- Rossi, M., Cattaneo, L., Le Duigou, J., Fugier-Garrel, S., Terzi, S. and Eynard, B. *Lean Product Development and the role of PLM*, PLM16, 13th International conference on Product Lifecycle Management, University of South Carolina, Columbia, 2016.
- Nabil, M., Zunino, P., Cattaneo, L., *A Computational Study of Microscale Flow and Mass Transport in Vasculatized Tumors,* 21st Iranian Conference on Biomedical Engineering (ICBME 2014), Biomedical Engineering Faculty, Amirkabir University ofTechnology (Tehran Polytechnic), Tehran, Iran, Nov 26-28, 2014.
- Cattaneo, L., Zunino, P., *Numerical investigation of convergence rates for the FEM approximation of 3D-1D coupled problems*, Proceedings Volume of ENUMATH 2013, Lausanne, August 2013. Springer-Verlag, 2014.
- Cattaneo, L., Chiastra, C., Cutrì, E., Migliavacca, F., Morlacchi, S., Zunino, P., *An immersed boundary method for drug release applied to drug eluting stents dedicated to arterial bifurcations*, Numerical Mathematics and Advanced Applications, Proceedings Volume of ENUMATH 2011, Leicester, UK, September 2011, Springer-Verlag, 2012.

Books

- Cattaneo, L. and Terzi, S. Models, Methods and Tools for Product Service Design. *The Manutelligence Project*, Springer Briefs in Applied Sciences and Technology, 2019.

Collaborations in past research projects

- *Mathematical Modelling and Simulation of the Cardiovascular System* (MATHCARD), ERC Advanced Grant no.: 227058, PI. A. Quarteroni, 2011-2013.
- *Manutelligence Project*, FOF7 Horizon2020, GA: 636951, 2015-2018.

Seminars and communications

- August 25-30, 2013, *Enumath 2013*, Lausanne, Swiss.
- July 22-25, 2013, *12th U.S. National Congress on Computational Mechanic*s, Raleigh, North Carolina, USA.
- June 10-13, 2013, *Modeling of Phisiological Flow*, Chia Laguna, Sardinia.
- June 25-28, 2012, *SIMAI Biannual Congresses*, Politecnico di Torino.

Teaching activities

- A. A. 2021-2022, A.A. 2022-2023 teaching assistant for the courses of *Metodi Matematici per le applicazioni industriali,* LIUC, Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2021-2022, A.A. 2022-2023 teaching assistant for the courses of *Mathematical Methods for Industrial Engineers,* LIUC, Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2021-2022, A.A. 2022-2023 teaching assistant for the courses of *Matematica per Economia, Finanza e Management,* LIUC, Castellanza (Bachelor Degree of Economics).
- A. A. 2022-2023 teaching assistant for the courses of *Data Mininig per l'Operational Excellence*, LIUC, Castellanza (Master Degree of Management, Economics and Industrial Eng).

- A. A. 2020-2021, A. A. 2021-2022 teaching assistant for the courses of *Data Analytics per la Fabbrica* and *Basics of Data Analytics*, LIUC, Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2020-2021, teaching assistant for the course *Asset Life Cycle Management*. Politecnico di Milano (Master Degree of Management, Economics and Industrial Eng).
- Lectures on Smart Maintenance for the Master "Manufacturing Management Industria 4.0", MIP, 2019, 2020, 2021, 2022.
- A. A. 2019-2020, A.A. 2020-2021, A.A. 2021-2022, teaching assistant for the course *Smart Manufacturing LAB.* Politecnico di Milano (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2019-2020, collaborator for the course *Asset Life Cycle Management*. Politecnico di Milano (Master Degree of Management, Economics and Industrial Eng).
- Lectures on Smart Maintenance for the Master MeGMI BG XIV edition, May and June 2019.
- A. A. 2017-2018, A. A. 2018-2019 lectures for the course Sistemi della Produzione**,** LIUC Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2017-2018, A. A. 2018-2019 lectures for the course Production Systems**,** LIUC Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2017-2018 teaching assistant for the course of *Industrial Technologies*. Politecnico di Milano (Master Degree of Management, Economics and Industrial Eng).
- A. A. 2017-2018, A. A. 2018-2019, A. A. 2019-2020, A. A. 2020-2021 lectures for the course of *Quality Design and Management.* LIUC Castellanza (Master Degree of Management, Economics and Industrial Eng).
- A.A 2017-2018, A.A. 2018-2019, A. A. 2019-2020, A. A. 2020-2021, A. A. 2021-2022, A. A. 2022-2023, lectures for the course of *Analisi Matematica.* LIUC Castellanza (Bachelor Degree of Management, Economics and Industrial Eng).
- October 2014 - July 2015: math and physics teacher at Liceo Artistico Statale "Paolo Candiani", Busto Arsizio, Italy.
- A. A. 2011-2012, A. A. 2012-2013, A. A. 2013-2014, A. A. 2015-2016, A. A. 2017-2018: teaching assistant (Computer sessions with Matlab) for the course of *Metodi analitici e numerici per l'Ingegneria*. Politecnico di Milano (Bachelor Degree of Mechanical Eng - III year) (IT).
- A. A. 2011-2012: teaching assistant (Computer sessions with Matlab) for the course of *Calcolo Numerico*. Politecnico di Milano (Bachelor Degree of Biomedical Eng - III year) (IT).

Awards

Scholarship bestowed by "Famiglia Legnanese".
The scholarship was conferred in recognition of university results. Legnano, November 2008, Italy.

Sport activities

- Volleyball player (since 1992) within the female volleyball team "ASD Sacro Cuore", Castellanza (Italy), Second and First Division, FIPAV.
- Volleyball coach (2010-2011) of the Under16 female volleyball team, "ASD Sacro Cuore", Castellanza (Italy). Participation in regional championship (PGS).

Driving licence: B

Autorizzo al trattamento dati ai sensi del GDPR 2016/679 del 27 aprile 2016 (Regolamento Europeo relativo alla protezione delle persone fisiche per quanto riguarda il trattamento dei dati personali).

Milano, January 2023
Laura Cattaneo