Adalberto Polenghi

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adalbertopolenghi

Curriculum Vitae

Current positions

2022-present **Assistant professor**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy.

Responsibilities, Didactic activities relate to courses at Bachelor, Master and Post-graduate level. The core topics of the lectures relate to the management of operations with special attention towards advanced maintenance practice, hence including reliability engineering, prognostics and health management, data analytics. Research activities refer to advanced modelling for maintenance purposes with the adoption of symbolic and non-symbolic Artificial Intelligence towards digital twinning. Specifically, the research activities are directed towards the sustainable management of assets, by improving their energy efficiency and consumption of resources.
`https://www.dig.polimi.it/en/staff/adalberto.polenghi`

2022-present **Member of the Core Faculty**, *POLIMI GSOM (Politecnico di Milano Graduate School of Management*, Milan, Italy.

Responsibilities, The main reponsabnilities refer to both organisation and teaching of courses and modules therein, especially referring to content like maintenance engineering, Industrial Asset Management, and related emerging technologies.
`https://www.gsom.polimi.it`

2022-present **Area manager**, *MADE competence center I4.0*, Milan, Italy.

Responsibilities, The main activities relate to the definition of the technological advancements in relation to use cases for process monitoring, energy monitoring, and smart maintenance, as well as the management of resources related to use cases and demonstrations.
`https://www.made-cc.eu`

2023-present **UNI/CT 153 Committee member**, *International Organization for Standardization*, Italy.

Responsibilities, Member of the committee of the UNI/CT 153 - Industrial Automation, specifically referring to development and usage of ontologies in industry.

2023-present **IFAC TC 5.1 AMEST WG Member**, *International Federation of Automatic Control.*

Responsibilities, Member of the AMEST WG - Advanced Maintenance Engineering, Services and Technologies, whose mission is “”to create, share and promote new knowledge pertaining to the technology, engineering and management of advanced maintenance systems”.
`https://tc.ifac-control.org/5/1/scope`

Short summary

Adalberto Polenghi is Assistant professor in the Manufacturing Group of Politecnico di Milano, Department of Management, Economics and Industrial Engineering. He obtained his PhD in the same department with a dissertation on ontological modeling for smart maintenance. His research interests relate to operations management, especially maintenance and Industrial Asset Management in manufacturing, with focus on data modelling, ontology engineering, reliability engineering and data analytics. He is involved in international and national research projects, as well as private funding industrial projects. He is in the scientific group of the TeSeM (Technologies and Services for Maintenance) observatory. He is the co-director of the Industry 4.0 Laboratory at Politecnico di Milano. Also, he is area manager at competence center MADE, specifically for the activities related to smart maintenance and smart energy management. He is responsible for the Smart Manufacturing Lab course at the Master level in Management Engineering; furthrmore is a teaching assistant for different courses at Bachelor and Master level related to the management of production systems, with special attention towards reliability engineering, prognostics and health management, and industrial asset management. Furthermore, he is lecturer for courses related to smart manufacturing and Industry 4.0 at POLIMI Graduate School of Management.

Education

2017 - 2021 **PhD cum laude in Industrial Engineering**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy.

Thesis title, *Towards a modern maintenance practice in manufacturing by empowering information management and integration.*
The PhD research is focused on the management of information and data to support a modern maintenance practice in the optics of Industrial Asset Management. During the PhD, advanced data analytics techniques and ontology engineering are exploited to support the digitalisation process of companies by semantically and technically integrating and empowering dispersed data and information. To this end, the analysis of the maintenance process, its information systems and the ensemble of data and information is a cornerstone of the research.

2014-2017 **Master of Science in Mechanical Engineering**, *Politecnico di Milano*, Milan, Italy, Final mark: 104/110.

Thesis title, *Simulation-supported framework for job shop scheduling with genetic algorithm*, The Thesis explores the potentialities of meta-heuristic algorithms combined with the simulation approach for production management. Thus, a discrete event simulation-based solution is developed to optimise a certain production schedule in a job shop environment by reducing the makespan.
`http://hdl.handle.net/10589/133918`

2011-2014 **Bachelor of Science in Mechanical Engineering**, *Politecnico di Milano*, Milan, Italy, Final mark: 94/110.

Research positions

2021 **Postdoctoral researcher**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy.

Research project, The research project deals with the digitalisation of manufacturing operations management through the application of several modeling techniques, ranging from traditional BPM (Business Process Modeling) through Artificial Intelligence, including symbolic and non-symbolic AI, to statistics. Special attention is given to the operations management in discrete manufacturing companies, with focus on industrial asset management and maintenance management, but also looking at their interface with production planning and control.

2017 - 2020 **Researcher**, *Observatory TeSeM (Technologies and Services for Maintenance) - Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Different research activities, based on interviews and analysis in the context of maintenance to depict the state-of-the-art in the Italian scenario regarding maintenance process maturity in terms of process completeness, adoption of new and advanced technologies and data analytics.

July 2017 - October 2017 **Research fellow in Industrial Engineering**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy, Focus on scheduling activity improvement, thanks to the new technology made available by the paradigm of Industry 4.0. The improvement of scheduling techniques involves the introduction of simulation as important tool to test the sequences and the plans created by the scheduling algorithm.

Other University positions

2022-present **Co-director of the Industry 4.0 Lab**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy, Responsabilities for laboratory activities related to both academic research as well as organizational and managerial aspects.

2022-present **Member of CEID - Centro Eccellenza ed Innovazione Didattica - Centre for Excellence and Innovation for Didactics**, *Politecnico di Milano, Department of Management, Economics and Industrial Engineering*, Milan, Italy, Member of CEID, which is committee at the service of the Head of the Department to support in decisions related to improvement of didactics for undergraduates, graduates as well as internal continuous learning activities for researchers and professors.

Visiting periods at foreign universities

August - October 2024 **Visiting Researcher**, *Chalmers University of Technology, Sweden.*
Studies on how to apply Asset Management and Maintenance engineering practices to scaled-up battery manufacturing.

April - July 2019 **Visiting PhD student**, *University of Seville, Spain.*
Studies on data modelling for evaluation of asset criticalities for maintenance strategies planning.

July - August 2018 **Visiting PhD student**, *University of Cincinnati, Ohio, USA.*
Analysis on how the Cyber-Physical Systems (CPS) may support scheduling and maintenance processes.

Projects

International and National funded projects

November 2023 - October 2026 **METABRAKE - Brembo**, *The project aims to explore how the Industrial Metaverse concept can be adopted to foster the co-design of innovative products and manufacturing systems so that the overall time-to-market is reduced. The project relies on advanced technologies in terms of software and hardware and heads towards the integration of the humans in an immersive environment to make more informed decisions about possible design changes or inconsistencies between virtual models*, https://www.brembo.com/en/sustainability/esg/environment/innovation.

November 2019 - July 2021 **LIGHTHOUSE PLANT - Ansaldo Energia**, *The project aims at implementing typical Industry 4.0-related technologies in a complex production system. Especially, the part of the project I am involved is focused on the digitalisation of maintenance, including prognostics and health management as well as an improvement of the CMMS, Computerized Maintenance Management System*, funded by Ansaldo Energia and partially by MISE (Italian Ministry of Economic Development) and Liguria Regional Administration, https://www.ansaldoenergia.com/Pages/Lighthouse-Plant.aspx.

November 2017 - June 2019 **INNOWAG - Innovative Monitoring and Predictive Maintenance Solutions on Lightweight Wagon**, *The project aims at optimising the fright wagon maintenance by exploiting operational data from sensors and statistical algorithms*, grant agreement No. 730863 — INNOWAG — H2020-S2RJU-2015-01/H2020-S2RJU-OC-2015-01-2, http://newrail.org/innowag/.

January - December 2018 **Sustain-Owner - Sustainable Design and Management of Industrial Assets through Total Value and Cost of Ownership**, *Project dedicated to funding mobility of research*, grant agreement number 645733 - SustainOwner - H2020-MSCA-RISE-2014, https://cordis.europa.eu/project/rcn/194374/factsheet/en.

Private funded projects - principal investigator

Dicember 2023 - present **Sonatrach Raffineria Italiana**, *Enabling condition-based maintenance in the oil sector: operational risks assessment and reliability evaluation of centrifugal pumps serving the refining process*, The project targets the development of ad-hoc risk analysis baed on FMECA approach for centrifugal pumps to prioritize critical failure modes and then evaluate reliability of most relevant component to evalute possible condition monitoring needs.

Private funded projects - team member

May 2024 - present **RFI (Italian railway infrastructure manager)**, *Revision of Maintenance Engineering system and development of a model for criticality analysis for the management of assets in RFI*, The project aims to revise and improve current practice in Maintenance Engineering within RFI by reviewing processes, develop a performance measurement system, and introduce new tools.

May 2023 - present **A2A (Multi-utility Italian operator in energy sector)**, *Development of Maintenance Engineering as a centralized group function*, The project aims to support a change management process of the maintenance engineering function by enabling its activities via a new set of performance indicators and maintenance-related tools for transversal governance of processes.

July 2022 - November 2022 **NTV (High-speed train operator)**, *Enhancement of the reliability and residual value of the train asset at the end of the service contract*, The project aims to evaluate reliability indicotrs so to judge current performance and evaluate possible re-investment given the forecasted residual train value.

April 2021 - November 2021 **UIC (International Union of railways)**, *Maximising the benefits of Big Data for Asset Management*, The project aims at analysing Big Data methods and tools to support strategic Asset Management decision for railway infrastructure managers.

December 2019 - July 2020 **Saras-SARTEC**, *Prognostics of industrial assets in absence of run-to-failure data*, The project aims at developing methodologies and algorithms for the anomaly detection and prognosis of complex industrial assets with low or no availability of run-to-failure data combining statistical and machine learning approaches.

March - June 2020 **Brembo**, *Development of anomaly detection and prognosis of critical heavy assets*, The project aims at developing machine learning algorithms to support the real-time monitoring of critical heavy assets.

September 2018 - September 2019 **Ferrero Technical Services**, *Development of the Reliability & Maintenance Engineering approach for the management of performance, costs and risk of industrial asset through their life cycle*, The project aims at supporting the design and continuous improvement of maintenance strategies leveraging on an update of the IT ecosystem to support centralised operations controlling over dispersed plants.

December 2017 - June 2018 **RFI - Rete Ferroviaria Italiana**, *Semantic data model to support the management of procedural documentation of a system of railway assets*, The project aims at supporting the development and management of procedures, in terms of structure and content.

July - November 2017 **RFI - Rete Ferroviaria Italiana**, *The Total Cost of Ownership for asset management decisions support of a railway infrastructure manager: the decision-making framework, the model and methodology*, The project aims at supporting the development of the Total Cost of Ownership to support asset decisions in BoL and MoL.

International collaborations

2022 - present **Université de Lorraine, CRAN, CNRS**, *The objective of the collaboration is to develop a symbolic AI model that entails sustainability indicators from each of the three dimensions for a more robust and informed maintenance decision-making.*

Didactics

2023-present **Course responsible**, *Politecnico di Milano*, Milan, Italy.

Courses:

- 2024 Smart Manufacturing Laboratory - Master level
- 2023 Smart Manufacturing Laboratory - Master level

2020-present **Lecturer**, *Politecnico di Milano Graduate School of Management*, Milan, Italy.

Courses:

- 2023 MEGMI (Master Executive in Asset Management and Maintenance Management) - Asset management and Smart Maintenance lectures
- 2022 MEGMI (Master Executive in Asset Management and Maintenance Management) - Asset management lectures
- 2021 MEGMI (Master Executive in Asset Management and Maintenance Management) - Smart maintenance lectures
- 2020 Value-based Plant Management: Methods and Solutions for XSIGHT - SAIPEM

2018-present **Tutor**, *Politecnico di Milano Graduate School of Management*, Milan, Italy.

Tutor of the project works within the MEGMI (Master Executive in Asset Management and Maintenance Management) aimed at supporting students in facing industrial challenges

2018-present **Teaching Assistant at Master level**, *Politecnico di Milano*, Milan, Italy.

Courses:

- 2023 Asset Life Cycle Management (Smart Maintenance Management and Industrial Asset Management)
- 2022 Asset Life Cycle Management (Smart Maintenance Management and Industrial Asset Management)
- 2019 Industrial Technologies

2018-present **Teaching Assistant at Bachelor level**, *Politecnico di Milano*, Milan, Italy.

Courses:

- 2023 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi)
- 2022 Industrial Plants and Production Management (Impianti Industriali e Gestione della Produzione)
- 2022 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi)
- 2021 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi)
- 2020 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi)
- 2018 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi)

2017-present **Tutor at Bachelor and Master levels**, *Politecnico di Milano*, Milan, Italy.

Courses:

2023 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi), Bachelor
2022 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi), Bachelor
2021 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi), Bachelor
2020 Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi), Bachelor
2019 Industrial Technologies, Master
2018 Industrial Technologies, Master
Management of Production and Logistics Systems (Gestione dei Sistemi Logistici e Produttivi), Bachelor
2017 Gestione degli Impianti Industriali (Management of Industrial Plants), Bachelor

Working experience

January - May 2017 **Internship**, *Bosch-VHIT S.p.A.*, Offanengo, Italy.
The Internship was devoted to support the R&D Department in the development of a new product: the activity includes most of the phases, from the product definition to prototyping.

July, 2016 **Kaizen Course and Application**, *Pietro Fiorentini divisione Samgas*, Vernate, Italy.
Improvement of the company's processes to reduce non-value adding activities:
- Training course about *Kaizen* methodology
- Development and implementation of the *Kanban* warehouse management system

Awards

2022 Best Paper "Innovations in Asset Management" *A methodology for ensuring strategic alignment of railway infrastructure asset management processes*, 16th World Congress on Engineering Asset Management WCEAM2022, Seville, 5-7 October 2022

2022 Excellence In Railway Publication Award *Maximising the value of Big Data for Asset Management*, IRS (Internal Railways Solutions) by International Union of Railways, October 2022

2024 Best Paper Award finalist *Digital Twins in Manufacturing: A Three-layer Heat-map Analysis*, 18th IFAC Symposium on Information Control Problems in Manufacturing (INCOM 2024), Vienna, 28-30 August 2024

Publications

Author's identifiers:
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- Scopus ID: 57200249304

Please refer to the Scopus and Google Scholar profile for an always updated list of publications by clicking on the following links:
- Scopus Author Dashboard
- Google Scholar Profile

Journal articles

2023 Macchi M., Cattaneo L., Polenghi A., Bruno D., Mosci S., Ferriani F. and Caneva R.(2023) *Operations-aware novelty detection framework for CNC machine tools: proposal and application*, The International Journal of Advanced Manufacturing Technology, 128.9-10, 4491-4512

2023 Polenghi A., Cattaneo L. and Macchi M. (2023) *A framework for fault detection and diagnostics of articulated collaborative robots based on hybrid series modelling of Artificial Intelligence algorithms*, Journal of Intelligent Manufacturing, 1-19

2022 Polenghi A., Roda I., Macchi M., Pozzetti A. and Panetto H. (2022) *Knowledge reuse for ontology mod-*

elling in Maintenance and Industrial Asset Management, Journal of Industrial Information Integration, 27, 100298

2022 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2022) *Ontology-augmented Prognostics and Health Management for shopfloor-synchronised joint maintenance and production management decisions*, Journal of Industrial Information Integration, 27, 100286

2022 Cattaneo, L., Polenghi A., Macchi M. (2022) *A framework to integrate novelty detection and remaining useful life prediction in Industry 4.0-based manufacturing systems*, International Journal of Computer Integrated Manufacturing, 35:4-5, 388-408

2022 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2022) *Information as a key dimension to develop industrial asset management in manufacturing*, Journal of Quality in Maintenance Engineering, Vol. 28 No. 3, pp. 567-583.

2022 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2022) *An ontological modelling of multi-attribute criticality analysis to guide Prognostics and Health Management program development*, Autonomous Intelligent Systems, 2, 2.

2021 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2021) *A methodology to boost data-driven decision-making process for a modern maintenance practice*, Production Planning & Control, in press

2021 Polenghi A., Cattaneo L., Macchi M., Pasanisi D., Pesenti V. and Borgonovo A. (2021) *Development of an advanced condition-based maintenance system for high-critical industrial fans in a foundry*, IFAC-PapersOnLine, 55(2), 48-53.

2020 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2020) *Data taxonomy to manage information and data in Maintenance Management*, IFAC-PapersOnLine, 53(3), 245-250

2019 Fumagalli L., Polenghi A., Negri E., Roda I. (2019) *Framework for simulation software selection*, Journal of Simulation, 1(1), 1-18

2018 Fumagalli L., Negri E., Sottoriva E., Polenghi A., and Macchi M. (2018) *A novel scheduling framework: integrating genetic algorithms and discrete event simulation*, International Journal of Management and Decision Making, 17(4), 371-395

2018 Storti E., Cattaneo L., Polenghi A. and Fumagalli L. (2018) *Customized Knowledge Discovery in Databases methodology for the Control of Assembly Systems*, Machines, 6(45)

2018 Polenghi A., Fumagalli L. and Roda I. (2018) *Role of simulation in industrial engineering: focus on manufacturing systems*, IFAC-PapersOnLine, 51(11), 496-501

Conference articles

2022 Roda, I., Fochesato, D., Polenghi, A., Luciano, M., Tordi, I., Di Pasquale, L., and Cavaiuolo, I. (2022) *A Methodology for Ensuring Strategic Alignment of Railway Infrastructure Asset Management Processes*, World Congress on Engineering Asset Management (pp. 405-415). Cham: Springer International Publishing

2022 Roda, I., Polenghi, A., and Männistö, V. (2022) *Big Data Adoption in Strategic Decision-Making for Railway Infrastructure Asset Management*, World Congress on Engineering Asset Management (pp. 428-438). Cham: Springer International Publishing

2021 Franzini A., Polenghi A., Roda I. And Macchi M. (2021) *System-Level Overall Equipment Effectiveness for Improving Asset Management Performance: A Case Study Application*, IFIP Advances in Information and Communication Technology 633, APMS 2021, Nantes, France, 5th - 9th September 2021, 410-417

2020 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2020) *A Conceptual Model of the IT Ecosystem for Asset Management in the Global Manufacturing Context*, IFIP Advances in Information and Communication Technology 592, APMS 2020, Novi Sad, Serbia, 30th August - 3rd September 2020, 711-719

2020 Acerbi F., Polenghi A., Roda I., Macchi M. and Taisch M. (2020) *Exploring Synergies Between Circular Economy and Asset Management*, IFIP Advances in Information and Communication Technology 592, APMS 2020, Novi Sad, Serbia, 30th August - 3rd September 2020, 695-702

2020 Polenghi A., Cattaneo L. and Macchi M.(2020) *A semantic-driven approach for data analytics to support Prognostics and Health Management*, Proceedings of the XXV Summer School of Industrial System Engineering "Francesco Turco", Bergamo, Italy (in publication)

2019 Polenghi A., Roda I., Macchi M. and Trucco P. (2019) *Risk sources affecting the Asset Management decision-making process in manufacturing: a systematic review of the literature*, IFIP Advances in Information and Communication Technology 566, APMS 2019, Austin, Texas, USA, 1st - 5th September 2019, 274-282

2019 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2019) *Conceptual framework for a data model to support Asset Management decision-making process*, IFIP Advances in Information and Communication Technology 566, APMS 2019, Austin, Texas, USA, 1st - 5th September 2019, 283-290

2019 Polenghi A., Roda I., Macchi M. and Pozzetti A. (2019) *Investigating information and data criticality in Asset Management decision-making process*, Proceedings of the XXIV Summer School of Industrial System Engineering "Francesco Turco", Brescia, Italy, 67-73

2017 Fumagalli L., Macchi M., Negri E., Polenghi A. and Sottoriva E. (2017) *Simulation-supported framework for job shop scheduling with genetic algorithm*, Proceedings of the XXII Summer School of Industrial System Engineering "Francesco Turco", Palermo, Italy, 271-278

Other publications

2020 Polenghi A. and Roda I. (2020) *Fondamenti dell'approccio Asset Management e sfide per il suo impiego nel manifatturiero: Problematiche aperte e opportunità di sviluppo per tale approccio nel settore (Fundamentals of the Asset Management approach and challenges for its implementation in manufacturing: open issues and opportunities for its development in the sector)* - April 2020 "Asset Management", Manutenzione Tecnica & Management, TIM Global - `https://www.manutenzione-online.com`

2018 Macchi M., Trapani N., Fumagalli L., Roda I., Polenghi A. and Sottoriva E. (2018) Observatory TeSeM - *Manutenzione nell'Industria 4.0: quali strategie per governare la trasformazione digitale? (Maintenance in the Industry 4.0: what strategies to govern the digital transformation?)* - Report April 2018 - `www.tesem.net`

Reviewing activities

- Reliability Engineering & System Safety
- Computers in Industry
- Engineering Applications of Artificial Intelligence
- Journal of Intelligent Manufacturing
- International Journal of Computer Integrated Manufacturing
- Journal of Quality in Maintenance Engineering
- Journal of Industrial Information Integration
- IEEE Access
- Neural Computing and Applications

Languages

Italian	Mother tongue	
English	Technical language proficiency	*Certified level B2*

Certifications

IPMA	Introductory Certificate in Project Management - Rules, methodologies and basic competences of Project Management, released by IPMA Italy
MatLab	MathWorks Certified MatLab Associate - certification obtained on March 12, 2018
Profession	Exam held to practice Industrial Engineering profession
ECDL	European Computer Driving License, released by AICA

IT Skills

Microsoft Office	Word, Power Point, Excel and Outlook
Microsoft Project	Software devoted to the scheduling, management and controlling of project activities
Matlab	Programming language (certified knowledge)
Simulink	Simulation of systems in the MatLab environment
Python	Programming language
Minitab	Software for statistical analysis

Interests

Swimming	Amateur level
Mountain-biking	Amateur level

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