

# Lorenzo Cavallucci

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## Professional Experiences

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| 2025<br>now  | <b>Adjunct professor</b> at the Department of Civil, Chemical, Environmental, and Materials Engineering Department of Industrial Engineering                           |
| 2025<br>now  | <b>Research fellow</b> at the Department of Electrical, Electronic, and Information Engineering “Guglielmo Marconi”                                                    |
| 2022<br>2025 | <b>Junior assistant professor (Rtda)</b> at the Department of Electrical, Electronic and Information Engineering “Guglielmo Marconi”                                   |
| 2018<br>2022 | <b>Post-Doctoral Researcher</b> at the Department of Electrical, Electronic and Information Engineering “Guglielmo Marconi”                                            |
| 2015<br>2018 | <b>Ph.D.</b> in Applied Superconductivity at the University of Bologna (Italy) - Department of Electrical, Electronic and Information Engineering “Guglielmo Marconi”. |

## Research Activities

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| 2024 | <b>ITER Project</b> , St Paul Lez Durance, France                                                                                                                                                                                                                                                                                                                      |
| 2026 | Electromagnetic and thermal-hydraulic analysis of superconducting magnets for the ITER Project; analysis of CICC samples tested at the SULTAN facility (Villigen, Switzerland); member of the testing group for the CS modules tested at General Atomics (Poway, USA); member of the testing group for the MCTF facility at the ITER Organization (Cadarache, France). |
| 2024 | <b>European Project “Mares”</b>                                                                                                                                                                                                                                                                                                                                        |
| 2028 | The Mares EU project aims to develop a highly efficient Reciprocating Superconducting Generator (RSG), capable of enhancing the performance and sustainability of renewable energy systems in the ocean.                                                                                                                                                               |
| 2022 | <b>PRIN Project “Tricheco”</b>                                                                                                                                                                                                                                                                                                                                         |
| 2025 | The PRIN project aims to develop an hybrid superconducting pipeline capable of simultaneously transporting electrical power and liquid hydrogen (LH <sub>2</sub> ), exploiting MgB <sub>2</sub> superconducting cables cooled by the hydrogen itself.                                                                                                                  |
| 2022 | <b>RSE Ricerca Sistema Energetico</b> , Milan, Italy                                                                                                                                                                                                                                                                                                                   |
| 2028 | Electromagnetic and fluid-dynamic modelling of superconducting cables for power applications.                                                                                                                                                                                                                                                                          |

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| 2026 | <b>National High Magnetic Field Laboratory, NHMFL</b> , Tallahassee, US                                                                             |
| 2015 | Electromagnetic and circuital FEM modelling of the 32 T superconductive magnet, and of the prototype coils in the frame of the 40 T magnet project. |
| 2025 | <b>Coesia Group</b> , Bologna, Italy                                                                                                                |
| 2022 | Sustainability of electric consumptions in packaging machines. .                                                                                    |
| 2015 | <b>ENEA Frascati Superconductivity Laboratory</b> , Frascati, Italy                                                                                 |
| 2024 | Electromagnetic FEM modelling of HTS twisted-stacked cables for fusion applications.                                                                |
| 2017 | <b>University of Southampton</b> , United Kingdom                                                                                                   |
|      | Electromagnetic FEM modelling of superconductive HTS Roebel cables and coils.                                                                       |
| 2017 | <b>Paul Scherrer Institute PSI</b> , Villigen, Switzerland                                                                                          |
| 2015 | AC losses and thermal stability in the superconductive Gantry magnet.                                                                               |
| 2013 | <b>Amplio Solar Group</b> , Bologna, Italy                                                                                                          |
|      | Multiphysics and circuital modelling of Vanadium Redox and Zinc Bromide flux batteries for energy storage.                                          |

## Education

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|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| May 2018    | <b>Ph.D. graduation (XXX cycle) Doctoral Degree in Biomedical, Electrical and Systems Engineering</b> at the University of Bologna (Italy) - Department of Electrical, Electronic and Information Engineering “Guglielmo Marconi”. |
| Jul. 2014   | <b>Professional Industrial Engineering Qualification</b> , University of Bologna (Italy).                                                                                                                                          |
| Oct. 2011   | <b>Master’s Degree in Energy and Nuclear Engineering</b> , University of Bologna (Italy).                                                                                                                                          |
| Mar. 2014   |                                                                                                                                                                                                                                    |
| Sep. 2008   | <b>Bachelor’s degree in Energy and Nuclear Engineering</b> , University of Bologna (Italy).                                                                                                                                        |
| Oct. 2011   |                                                                                                                                                                                                                                    |
| 2003 - 2008 | <b>Graduate</b> at Liceo Scientifico ‘Mario Allegretti’ - Vignola (Italy).                                                                                                                                                         |

## Teaching Activities

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| 2026 / 2027 | <b>Teacher of <i>Electrotechnics of Energy Systems M (Module 2)</i></b> , Master Degree in Engineering Management, University of Bologna.                |
| 2026 / 2027 | <b>Teacher of <i>Elements of Electric Engineering T (Module 2)</i></b> , Bachelor Degree in Chemical and Biochemical Engineering, University of Bologna. |
| 2025 / 2026 | <b>Teacher of <i>Electrotechnics of Energy Systems M (Module 2)</i></b> , Master Degree in Engineering Management, University of Bologna.                |
| 2025 / 2026 | <b>Teacher of <i>Elements of Electric Engineering T (Module 2)</i></b> , Bachelor Degree in Chemical and Biochemical Engineering, University of Bologna. |
| 2024 / 2025 | <b>Teacher of <i>Electrotechnics of Energy Systems M (Module 2)</i></b> , Master Degree in Engineering Management, University of Bologna.                |
| 2024 / 2025 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 3)</i></b> P-BO, Bachelor Degree in Mechatronics, University of Bologna.                 |
| 2023 / 2024 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 3)</i></b> P-BO, Bachelor Degree in Mechatronics, University of Bologna.                 |
| 2023 / 2024 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 1)</i></b> P-IM, Bachelor Degree in Mechatronics, University of Bologna.                 |

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| 2022 / 2023 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 3)</i></b> P-BO, Bachelor Degree in Mechatronics, University of Bologna.     |
| 2022 / 2023 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 1)</i></b> P-IM, Bachelor Degree in Mechatronics, University of Bologna.     |
| 2021 / 2022 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 3)</i></b> P-BO, Bachelor Degree in Mechatronics, University of Bologna.     |
| 2021 / 2022 | <b>Teacher of <i>Laboratorio di Elettrotecnica e Misure (Modulo 1)</i></b> P-IM, Bachelor Degree in Mechatronics, University of Bologna.     |
| 2019 - 2022 | <b>Tutor of <i>Applied Electromagnetism</i></b> T, Bachelor Degree in Electrical Energy Engineering, University of Bologna.                  |
| 2015 - 2020 | <b>Tutor of <i>Elements of Electrical Engineering</i></b> T, Bachelor Degree in Chemical and Biochemical Engineering, University of Bologna. |
| 2015 - 2017 | <b>Tutor of <i>Electrotechnics</i></b> T-A, Bachelor Degree in Engineering Management, University of Bologna.                                |

## Conference Participations

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| September<br>2026 | <b>Applied Superconductivity Conference ASC</b> , Pittsburgh (USA), oral talk “Modeling of quench in the large-scale coil tested at the NHMFL for the 40 T magnet project”.                      |
| March<br>2026     | <b>CHATS on Applied Superconductivity</b> , Saariselka (Finland), oral talk “Methodology to predict the Tcs in ITER TF Coils based on Sultan Samples and TF Insert Coil Database”.               |
| July<br>2025      | <b>Magnet Technology Conference MT</b> , Boston (US), oral talk “Impact of axial and bending strain on the Tcs of ITER TF conductors under MTCB working conditions”.                             |
| September<br>2024 | <b>Applied Superconductivity Conference ASC</b> , Salt Lake City (USA), oral talk “Modeling of quench in a slotted core HTS cable for compact fusion reactors”.                                  |
| June<br>2024      | <b>Riunione annuale dei ricercatori di elettrotecnica</b> , Bari (Italia), poster presentation “Perdite durante transitori elettrodinamici nei moduli del solenoide centrale del progetto ITER”. |
| September<br>2024 | <b>European Conference on Applied Superconductivity EUCAS</b> , Bologna (Italia), oral talk “Modeling of quench in the ITER Poloidal Field Coil”.                                                |
| June<br>2023      | <b>Riunione annuale dei ricercatori di elettrotecnica</b> , Iseo (Brescia, Italia), poster presentation “Analysis of superconducting joints and coils for the ITER tokamak”.                     |
| June<br>2022      | <b>3rd International School on Modelling for Applied Superconductivity</b> , Saas Fee (Svizzera), lecture “Computer practice on Quench in HTS Tapes”.                                            |
| September<br>2021 | <b>CHATS on Applied Superconductivity</b> , ITER Cadarache (Francia), virtual conference, oral talk “Stability Analysis of the ITER Central Solenoid During the 15 MA DT Plasma Scenario”.       |

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| September 2021 | <b>European Conference on Applied Superconductivity EUCAS</b> , Mosca (Russia), virtual conference, poster presentation “Analysis of Electrodynamic Transients in the ITER PF Joints”.                            |
| October 2020   | <b>Applied Superconductivity Conference ASC</b> , Tampa (USA), virtual conference, oral talk “Quench Initiation and Propagation at Different Operating Conditions in a HTS Pancake Coil Wound with Roebel Cable”. |
| October 2018   | <b>Applied Superconductivity Conference ASC</b> , Seattle (USA), oral talk “A Numerical Study of Quench in the NHMFL 32 T Magnet”.                                                                                |
| September 2017 | <b>European Conference on Applied Superconductivity EUCAS</b> , Ginevra (Svizzera), poster presentation “Innovative Electro Thermal Modeling of Quench in REBCO Roebel Cables”.                                   |
| June 2016      | <b>1st International School on Modelling for Applied Superconductivity</b> , Losanna (Svizzera), student.                                                                                                         |

## Languages

|         |               |
|---------|---------------|
| Italian | Mother tongue |
| English | <b>B2</b>     |

## Computer skills

| Programs            | Languages | OS                |
|---------------------|-----------|-------------------|
| COMSOL Multiphysics | C++       | Microsoft Windows |
| Ansys Maxwell       | Fortran   | Linux             |
| Simulink            | Python    |                   |
| LTSPICE             |           |                   |
| MatLab              |           |                   |
| Solid Edge (CAD)    |           |                   |
| Thermoflex          |           |                   |
| LaTex               |           |                   |
| Microsoft Excel     |           |                   |

## Publications

- [1] M. Breschi, M. Casali, L. Cavallucci, G. De Marzi, and G. Tomassetti, “Electro-thermal analysis of a twisted stacked YBCO Cable in Conduit Conductor,” *IEEE Trans. Appl. Supercond.*, vol. 25, no. 3, June 2015.
- [2] M. Breschi, L. Cavallucci, P. L. Ribani, A. V. Gavrilin, H. W. Weijers, “Analysis of quench in the NHMFL REBCO prototype coils for the 32T Magnet Project,” *Supercond. Sci. Technol.* 29 (2016) 055002 (11pp).
- [3] M. Breschi, L. Cavallucci, P. L. Ribani, A. V. Gavrilin, H. W. Weijers, “Modeling of Quench in the Coupled HTS Insert/LTS Outsert Magnet System of the NHMFL,” *IEEE Trans. Appl. Supercond.*, vol. 27, no. 5, August 2017.
- [4] M. Breschi, L. Cavallucci, P. L. Ribani, C. Calzolaio and S. Sanfilippo, “Analysis of losses in superconducting magnets based on the  $Nb_3Sn$  Rutherford,” *Supercond. Sci. Technol.* 31 (2018) 015005 (12pp).

- [5] L. Cavallucci, M. Breschi, P. L. Ribani, Y. Yang, “Electrothermal Modeling of Quench in REBCO Roebel Cables,” *IEEE Trans. Appl. Supercond.*, vol. 28, no. 4, June 2018.
- [6] Q. Zhang, Y. Yang, E. Young, L. Cavallucci, A. Kario, W. Goldacker, A. Usoskin and L. Bottura, “Performance and Quench Characteristics of a Pancake Coil Wound With the 2G YBCO Roebel Cable,” *IEEE Trans. Appl. Supercond.*, vol. 28, no. 4, June 2018.
- [7] I. A. Azzollini, V. Di Felice, F. Fraboni, L. Cavallucci, M. Breschi, A. Dalla Rosa, and G. Zini, “Lead-Acid Battery Modeling Over Full State of Charge and Discharge Range,” *IEEE Trans. Power Systems.*, vol. 33, no. 6, Nov. 2018.
- [8] L. Cavallucci, M. Breschi, P.L. Ribani, A.V. Gavrillin, H.W. Weijers, P.D. Noyes, “A Numerical Study of Quench in the NHMFL 32 T Magnet,” *IEEE Trans. Appl. Supercond.*, vol. 29, no. 5, August 2019.
- [9] M. Breschi, L. Cavallucci, P.L. Ribani, R. Bonifetto, A. Zappatore, R. Zanino, F. Gauthier, P. Bauer, N. Martovetsky, “AC Losses in the First ITER CS Module Tests: Experimental Results and Comparison to Analytical Models,” *IEEE Trans. Appl. Supercond.*, vol. 31, no. 5, August 2021.
- [10] L. Cavallucci, M. Breschi, P.L. Ribani, J. Pelegrin, Q. Zhang, W. Bailey, Y. Yang, “Quench propagation at different conditions in an HTS pancake coil wound with Roebel cable,” *IEEE Trans. Appl. Supercond.*, vol. 31, no. 5, August 2021.
- [11] M. Breschi, L. Cavallucci, V. Tronza, N. Mitchell, P. Bruzzone, K. Sedlak, “Impact of mechanical and thermal cycles at different operating conditions on the ITER toroidal field coil conductor performance,” *Supercond. Sci. Technol.* 34 (2021) 085021
- [12] L. Cavallucci, M. Breschi, P.L. Ribani, Q. Zhang, Y. Yang, “Quench in a pancake coil wound with REBCO Roebel cable: model and validation,” *Supercond. Sci. Technol.* 34 (2021) 105002
- [13] M. Breschi, L. Cavallucci, P.L. Ribani, F. Gauthier, “Analysis of Electrodynamic Transients in the ITER PF Joints,” *IEEE Trans. Appl. Supercond.*, vol. 32, no. 4, 2022.
- [14] M. Breschi, L. Cavallucci, P. Bauer, F. Gauthier, R. Bonifetto, A. Zappatore, R. Zanino, N. Martovetsky, K. Khumthong, E. Ortiz, J. Sheeron, “AC Losses in the Second Module of the ITER Central Solenoid,” *IEEE Trans. Appl. Supercond.*, vol. 32, no. 6, 2022.
- [15] P. Bauer, M. Breschi, L. Cavallucci, J.L. Duchateau, F. Gauthier, A. Torre, B. Turck, “Description of the AC Loss Model for the ITER Central Solenoid During a Plasma Scenario,” *IEEE Trans. Appl. Supercond.*, vol. 32, no. 6, 2022.