Gianmario Pellegrino

Full Professor of Power Electronics, Electrical Machines and Drives

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Curriculum Vitae

Born in 1973. Married with two daughters.

Passions for outdoor sports, good people and good reading.

Overview of education and academic career

Graduated in Electrical Engineering with honors in 1998, Politecnico di Torino, Turin, Italy (PoliTO).

Ph.D. in Electrical Engineering in 2002, from PoliTO.

Academic career at PoliTO:

- Research Assistant from 2002
- Assistant Professor from 2007
- Associate Professor from 2014
- Full Professor since 2019.

Visiting scholar periods:

- Postdoc researcher at the University of Aalborg, Denmark for 8 months in 2002;
- Visiting scholar at the University of Nottingham, UK, PEMC group for 8 months between 2010 and 2011;
- Visiting scholar at the University of Wisconsin– Madison, USA in 2013 for two months.

I lead a group of one tenured and one non-tenured assistant professors, one research assistant and five PhD students.

I am the co-founder of the Power Electronics Innovation Center (PEIC) of PoliTO, a member of the Research Steering Board of PoliTO and the Rector's advisor for the implementation of the interdepartmental centers and the research platforms of PoliTO.

Fellowships and Career Awards

- IEEE Fellow, class of 2022, *for contributions to Synchronous Reluctance machines identification and control.*
- Recipient of the 8th Grand Nagamori Award for *Synchronous and PM-synchronous reluctance motor drives - theory, design, and control methods,* received by the hands of Mr. Nagamori, founder and CEO of NIDEC, Japan (*https://www.nidec.com/en/nagamori-f/ceremony/2022.html*)

Research numbers

- 211 Scopus-indexed scientific works, of which 64 Journal papers, 55 of 64 on IEEE Journals.
- Co-author of 2 books.
- 10 patents.
- H-index: 40 (Scopus), 42 (Scholar)
- Citations: 5488 (Scopus), 7412 (Scholar)

Patents

1. Method for tracking the MTPA without HF injection or look-up-tables in sensorless motor drives. Inventors: A. Bojoi, G. Pellegrino and P. Pescetto
2. A method and a device for controlling a three-phase motor. Inventors: G. Pellegrino and P. Pescetto
3. Method for Spatial Harmonic Flux-Map and Torque-Map Identification Without a Torque Transducer. Inventors: S. Ferrari, G. Pellegrino and P. Pescetto
4. Online MTPA Tracking for Synchronous Machines. Inventors: G. Pellegrino and A. Varatharajan
5. Fast High-Frequency Current Injection for Machine Controllers. Inventors: G. Pellegrino and A. Varatharajan
6. ISOLATED SEMI-INTEGRATED ON-BOARD BATTERY CHARGER (ISI-OBC) FOR ELECTRIC VEHICLES. Inventors: G. Pellegrino and P. Pescetto
7. METHOD AND SYSTEM FOR CHARACTERIZING JUNCTION TEMPERATURES OF POWER DIODES OF A VOLTAGE SOURCE INVERTER. Inventors: E. Armando, G. Pellegrino and F. Stella
8. Locus of Incremental Saliency Tracking (LIST). Inventors: G. Pellegrino and A. Varatharajan
9. METHOD AND SYSTEM FOR CHARACTERIZING JUNCTION TEMPERATURES OF POWER SWITCHES OF A THREE-PHASE VOLTAGE SOURCE INVERTER. Inventors: E. Armando, G. Pellegrino and F. Stella
10. Adaptive Projection vector for Position error estimation (APP) in sensorless synchronous reluctance motor drives for immunity from stator resistance variation. Inventors: G. Pellegrino and A. Varatharajan

Paper Awards

Me and co-authors received nine best paper awards between 2010 and 2021:

1. IAS Transactions Award, 2nd place, in 2021, for the paper "Winding Thermal Modeling and Parameters Identification for Multi Three Phase Machines Based on Short-Time Transient Tests", authors P. Pescetto, S. Ferrari, **G. Pellegrino**, E. Carpaneto and A. Boglietti.
2. IEEE IAS IDC 1st Prize Paper Award at the Energy Conversion Congress and Exposition (ECCE) 2020 for the paper "Standstill Determination of PM Flux Linkage Based on Minimum Saliency Tracking for PM-SyR Machines", authors P. Pescetto and **G. Pellegrino**
3. IEEE IAS IDC 3rd Prize Paper Award at the Energy Conversion Congress and Exposition (ECCE) 2018 for the paper "Automatic Tuning for Sensorless Commissioning of Synchronous Reluctance Machines Augmented with High Frequency Voltage Injection,", authors P. Pescetto and **G. Pellegrino**
4. International Conference on Electrical Machines (ICEM) 2016 Brian Chalmers Best Paper Award, for the paper "Sensorless self-commissioning of synchronous reluctance motors at standstill,", authors M. Hinkkanen, P. Pescetto, E. Mölsä, S. E. Saarakkala, **G. Pellegrino** and R. Bojoi.

5. IEEE IES EMTC Prize Paper Award, 2nd Prize, 2015, for the paper "High-speed scalability of synchronous reluctance machines considering different lamination materials", authors M. Palmieri, M. Perta, F. Cupertino and **G. Pellegrino**
6. IEEE IAS IDC 1st Prize Paper Award 2015, for the paper "Plug-in, direct flux vector control of PM synchronous machine drives", authors **G. Pellegrino**, B. Boazzo and T. M. Jahns.
7. IEEE IAS IDC 3rd Prize Paper Award 2010, for the paper "Unified Direct-Flux Vector Control for AC motor drives", authors **G. Pellegrino**, P. Guglielmi and R. Bojoi.
8. International Conference on Electrical Machines (ICEM) 2010 Brian Chalmers Best Paper Award, for the paper "Comparison between SPM and IPM motor drives for EV application", authors A. Vagati, **G. Pellegrino** and P. Guglielmi.
9. IEEE IAS EMC 3rd Prize Paper Award 2010, for the paper "Core loss and torque ripple in IPM machines: dedicated modeling and design trade off", authors **G. Pellegrino**, P. Guglielmi, A. Vagati and F. Villata.

International reputation

- Member of the Advisory Board of PCIM Europe since 2017.
- Associate Editor for the IEEE Transactions on Industry Applications since 2010.
- Member of the Editorial Board of the World Electric Vehicle Journal of MDPI.
- Guest Editor for the IEEE Journal on Emerging and Selected Topics in Power Electronics.
- Guest Associate Editor several times.

Conference organization

- General Chair of ICEM 2024, Torino
- Technical Program Chair of ECCE 2021, Vancouver, BC
- Track chair of ICEM 2022 Valencia
- Track chair of ICEM 2020 Goteborg
- Track chair of IESES 2020, Cagliari
- General Chair of IEEE SLED 2019, Torino
- Track chair of WEMDCD 2019, Athens
- Track chair of ICEM 2018 Alexandroupoli
- Track chair of ICEM 2012 Lausanne
- Several special sessions and tutorials.
- Topic Chair for IEEE ECCE for nine times between 2009 and 2017.

Invited Lectures and Tutorials

I gave seven tutorials at major IEEE conferences

- **Gianmario Pellegrino** and Simone Ferrari, Politecnico di Torino, "Design, Identification and Simulation of PM Synchronous Machines for Traction", 2022 XXV International Conference on Electrical Machines (ICEM), Valencia, Spain
- **G. Pellegrino**; I.R. Bojoi; P. Pescetto; S. Rubino, Politecnico di Torino "Control of AC eDrives: From Theory to Implementation", 2019 International Electric Machines & Drives Conference (IEMDC), San Diego, USA

- Nicola Bianchi, University of Padova, David Meeker, QinetiQ North America, Johan Gyselinck, Université Libre de Bruxelles, Ruth V. Sabariego, KU Leuven, Luigi Alberti, Free University of Bozen, **Gianmario Pellegrino**, Politecnico di Torino, Francesco Cupertino, Politecnico di Bari, "Electrical Machine Analysis using Free Software", 2017 IEEE Energy Conversion Congress & Exposition, Cincinnati, USA
- Nicola Bianchi, University of Padova; **Gianmario Pellegrino**, Politecnico di Torino, and Bulent Sarlioglu, University of Wisconsin-Madison, USA, "Design of Special PM Machines using FEA with Insights on Flux Switching and PM-assisted Machine Types", 2017 International Electric Machines & Drives Conference (IEMDC), Miami, USA
- Bulent Sarlioglu, University of Wisconsin-Madison, USA, and **Gianmario Pellegrino**, "Permanent Magnet Machine Design and Analysis Including Flux Switching PM and PM-Assisted Synchronous Reluctance Machines", 2016 XXII International Conference on Electrical Machines (ICEM), Lausanne, Switzerland
- **Gianmario Pellegrino**; Thomas Jahns; University of Wisconsin-Madison, USA; Nicola Bianchi, University of Padova, Italy; Wen Soong, The University of Adelaide, Australia; Francesco Cupertino, Politecnico di Bari, Italy, "The Rediscovery of Synchronous Reluctance and Ferrite PM Motors as Valid Competitors to Induction and Rare-earth PM Motors", 2014 IEEE Energy Conversion Congress & Exposition – Pittsburgh (USA)
- David A. Staton, Motor Design Ltd., UK; Dan M. Ionel, Vestas R&D Technology Americas, Inc., USA; David G. Dorrell, University of Technology Sydney, Australia, and **Gianmario Pellegrino**, Politecnico di Torino, Italy; "Practical Aspects in Modern Design Process of Electric Motors", 2011 IEEE Energy Conversion Congress & Exposition – Phoenix (USA)

I was keynote speaker at the following events, besides being panelist for ECCE and ITEC:

- PLECS annual conference in Zurich, 2022, lecture on "Integration of PLECS Circuital Models into the Open-Source Design Suite syreDrive"
- Matlab and Simulink Italian Academic Forum, 2022, lecture on "Simulation of Power Converters and Electric Drives"
- IEEE Croatia, Split, 2021, lecture on ""'Synchronous Reluctance Motor Drives: Introducing the Design Resource SyR-e and its new Dimension SyReDrive"
- The 3rd Huawey Magnetics Innovation Summit in 2020, lecture on "Electrical Machines in Automotive: under the hood".
- ACEM-OPTIM 2019 in Istanbul, Turkey, lecture on "Synchronous Reluctance Motor Drives: Still a niche Technology?"
- The European PhD School in Gaeta, Italy, in 2013, lecture on "PM assisted Variable Reluctance Machines"

I gave 10+ invited lectures at companies in Europe and in the USA. Selected examples:

- Tesla, Palo Alto, CA, USA, March 2024, "Use of SyR-e for the Identification and Control Simulation of Traction PMSMs"
- Mitsubishi Electric Research Laboratories, Cambridge, MA, USA, October 2022, seminar on "Design, Identification and Simulation of PM Synchronous Machines for Traction"
- ABB Corporate Research in Raleigh, NC, USA, November 2016, seminar on "Power Electronics, Machines and Drives at Politecnico di Torino"

- GE Global Research Center in Niskayuna, NY, USA, October 2015, seminar on "Power Electronics, Machines and Drives at Politecnico di Torino"
- United Technologies Research Center, East Hartford, CT, USA, November 2014, seminar on "Automated Design of Synchronous Reluctance and PM-Assisted Machines and their Plug-in Control"
- ABB Drives Oy, Helsinki, August 2014, seminar on "Steps towards a general-purpose, plug-in controller for synchronous machine drives"
- Ferrari Spa, Maranello, Italy, February 2013, workshop on "Electric machines and drives at Politecnico di Torino"

I gave several invited lectures at the following hosting universities, examples:

- University of Nottingham Ningbo, Ningbo, China, 2023, lecture on "Use of SyR-e for the Design, Identification and Simulation of Traction PMSMs"
- University of Eindhoven, The Netherlands, 2019, lecture on "SyR-e: An Open-Source Resource for Electrical Machines Design"
- Aalborg University, Denmark, 2018, lecture on "SyR-e: An Open-Source Resource for Electrical Machines Design"
- Aalto University, Finland, 2014, seminar on "PM-less and Reduced-Cost PM Machines and an Industry-Friendly Approach to Their Control"
- Illinois Institute of Technology, Chicago, IL, USA, 2013, seminar on "Recent Work on Reduced-Cost PM Machines and an Industry-Friendly Approach to Their Control"
- University of Wisconsin – Madison, Madison, WI, USA, 2013, seminar on "Recent Work on Reduced-Cost PM Machines and an Industry-Friendly Approach to Their Control"

Since 2014, I am an invited lecturer of the University of Wisconsin – Madison for the outreach course "Permanent Magnet Machine Design Boot Camp - Internal PM, Surface PM, and Brushless DC".

Collaboration with the industry and funded projects

The main sponsorship to the research activities under my responsibility comes from the collaboration with the industry. Through the years, I held the responsibility of 30+ research contracts and 10+ funded projects, with major companies such as Mitsubishi Electric, Schindler, ABB, FCA and now Stellantis, Volvo Cars, LG Electronics, GE Aviation, KSB, SF Motors (now Seres) and for smaller and less known local enterprises.

The topics of such research collaborations relate to the design and control of synchronous motor drives, with emphasis on design and test of prototypes of synchronous reluctance, PM-assited synchronous reluctance, interior and surface mounted PM synchronous machines ranging from 1 kW to 1 MW, their control with and without position transducer and the experimental identification of their parameters.

The cumulated budget of competitive and company funded projects under my responsibility is 3.8 M€ since 2019, 5.0 M€ since 2013 and 5.9M€ overall (since 2006).

Open-source project SyR-e

I am the co-founder and leader of the e-motor drives design environment SyR-e (Synchronous Reluctance – Evolution), whose source code is available at https://github.com/SyR-e. SyRe is a popular preliminary design tool adopted by partner industries, researchers and PhD students around the world.

PhD Students Supervision

I have supervised 13 PhD students since 2013, besides the current 3 PhD candidates.

Two of the current PhD candidates are sponsored by automotive companies (Ferrari, Volvo Cars, Infineon).

All graduates key R&D positions in major companies (GE Aviation, ABB, Mitsubishi Electric, AVL, BYD China, Tesla, Ferrari). Three of them became lecturers at Politecnico di Torino.

I am a member of the Academic Board of the PhD programme in Electrical, Electronic and Communication Engineering since 2015.

The following recognitions were awarded to students under my supervision:

1. 2022 – Paolo RAGAZZO, ICEM Jorma Luomi Best Poster Student Forum Award
2. 2019 - Paolo PESCETTO, IEEE IES "2019 Best PhD Thesis Award, IEEE Italy Chapter"
3. 2021 - Anantaram VARATHARAJAN, IEEE IES "2021 Best PhD Thesis Award, IEEE Italy Chapter"
4. 2015 – Matteo Gamba, Best Presentation Recognition at the 2015 IEEE Energy Conversion Congress and Exposition (ECCE), Montreal, QC

Current Teaching Activity

Most of the MSc courses I taught over my career were initiated by me, with minor or little link to existing teaching material. The same is true of the new BSc course of electrical machines for Automotive Engineering. Over the years, I struggled for providing the students of Electrical, Mechanical and Automotive Engineering with hands-on experience on power converters, electrical machines and drives. The renovation of teaching labs (developed under my responsibility in years 2015-2018) progressively enabled this hands-on experience possibility, reaching its steady-state in 2019.

Here are my current teaching duties (2 courses, one per semester).

1- Laboratory of Power Converters and Electrical Drives (01SRQNC)

Core course of the Electrical Energy Conversion career, MSc Degree in Electrical Engineering, 8 CFU, course started in the academic year 2018/19

8 credit course taught in English. 42 hours of theory and 42 hours of hands-on laboratory. The students are organized in eight groups of 4 people in the electrical drives Laboratory. Moreover, students have free access to the lab during the exam period, so to work autonomously on their final course project. The students' feedback deemed this course (respect to the 14 courses of the MSc degree in Electrical Engineering): the one with the highest overall satisfaction (97.7%), the best organized (96.7%), the best in terms of teacher's effectiveness (100%)

2- Electrical Machines (04LONLI)

Core course of the BSc Degree in Automotive Engineering, started in the academic year 2021/22

8 credit course taught in English. 62 hours of theory and 22 hours of exercises. The course was created from scratch to focus on topics of interest for transportation electrification, with continuous reference to real-world examples and vehicles and to new solutions (SiC inverters, integrated inverters, oil and hybrid cooling, etc ..). The course includes demonstrative lab experience.

Current Responsibilities

- Deputy Vice-Rector for Technological Transfer of Politecnico di Torino, since April 2024
- Member of the Japan Hub of Politecnico di Torino
- Member of the Board of Experts of INRIM (Italian National Institute of Metrology Research) on the topic "Better measurements for energy storage" since 2023
- Member of the Technology Development Community "Controls & Electrifiction" of Avio Aero (GE Aviation), since 2017.

Past Responsibilities

- Chair of the board of evaluators of Interdept. Centers and Platforms of Politecnico di Torino, 2024
- Member of the Research Steering Board of Politecnico di Torino 2018 - 2024
- Rector's Advisor for the Interdepartmental Centers, Politecnico di Torino 2018-2024
- Member of the National Committee of the National Scientific Habilitation (ASN) for the assessment of Associate and Full Professor candidatures in the field of Electrical Energy Engineering (2021–2023).
- Representative of Politecnico di Torino in the task force Infrastructures of the European Network CESAER between 2020 and 2022.
- Leader of the Work Package "Unite! Research and Innovation Agenda" within the H2020 Project for the creation of the Unite! Alliance, part of the European University Initiative between 2020 and 2022
- Member of the College of the studies in Electrical Engineering
- Co-founder of the Interdepartmental Laboratory PEIC (Power Electronics Innovation Center) of Politecnico di Torino in 2017.
- Member of the management committee of the PEIC in 2017-2018.
- Secretary and Vice-President of the CMAEL association, representative in Italy of the scientific sector ING-IND/32: Power Converters, Electrical Machines and Drives (2017-2020).
- Scientific coordinator of the agreement between the Energy Department (DENERG) of the Politecnico di Torino and National Instruments Italy Srl., 2017-2020
- Departmental coordinator for International Students Exchange in Electrical Engineering (2014 – 2018)
- Responsible for the renovation of the teaching laboratories of Electrical Engineering (2015-2018).