



**UNIVERSITÀ DEGLI STUDI DELL'AQUILA**  
**Prof. Marco Antonio Villani**  
**Curriculum scientifico**

(Aggiornato il 2024/04/03)

Marco Villani received the M.S. degree in electrical engineering from the University of L'Aquila, Italy, in 1985. In the same year he joined the Department of Electrical Engineering of University of L'Aquila as Associate Researcher, contributing to the development of the Power Electronics and Drives Laboratory "F. Ferri". In 1987 he received the "Ferdinando Filauro" scholarship and in 1988 he was Research Fellow at the University of Dresden where he studied the modeling and design of stepping motors. In 1995 he was at the Nagasaki University for a research activity on the design of PM synchronous motors for traction. In 1998 he cooperated in two SAVE projects concerning the "Energy efficiency improvements in three-phase Induction Motors" and the "Barriers against energy efficient motor repair".

He has been involved in National Research Projects (CNR, MIUR and COFIN) and took the responsibility of several research contracts between the University of L'Aquila and industrial partners. He has been project in charge, for the University of L'Aquila, of the Horizon 2020-Call Green Vehicles (2017-2020) project on the automotive, titled "RefreeDrive" and the MIUR project ("Progetti di ricerca industriale e sviluppo sperimentale nelle 12 aree di specializzazione individuate dal PNR 2015-2020, area di specializzazione: Aeroporto") titled "LubforLife"

Reference Teacher for the bilateral agreements of Erasmus programs with the ESIEE-École Supérieure d'Ingénieurs en Électrotechnique et Électronique of Amiens (France) and with the KUT - Kaunas University of Technology of Kaunas (Lithuania), for the period 2007-2010.

He is reviewer for several International Conferences and Journals, including IEEE Transaction on Industry Applications and Energy Conversion, Journal of Energy Efficiency, IEEE Conference of Industrial Electronic Society (IECON), International Conference on Electrical Machines (ICEM).

He is Full professor of "Electrical Machines Design" and "Mobility and Electric Vehicles" for the Master-level degree courses of Electrical Engineering at the University of L'Aquila.

His research interests are focused on modeling and design of electrical machines, high efficiency induction motors (IE3,IE4), line-start synchronous Reluctance motors, design of brushless motors for household appliances, optimization techniques for the electrical machines design, Finite Element

analysis of electrical machines, design of PM synchronous motors, Reluctance motors and Switched-Reluctance motors for industrial, automotive and aerospace applications.

He is author of more than 180 technical papers in scientific journals and conference proceedings.

### **Publications of the last 10 years**

F.Parasiliti, M.Villani, S. Lucidi, F.Rinaldi "Finite Element Based Multi-Objective Design Optimization Procedure of Interior Permanent Magnet Synchronous Motors for Wide Constant-Power Region Operation", IEEE Transactions on Industrial Electronics, vol. 59, pp. 2503-2514, ISSN: 0278-0046, DOI: 10.1109/TIE.2011.2171174.

M. Villani, M. Tursini, G. Fabri, L. Castellini "High reliability permanent magnet Brushless motor drive for aircraft application", IEEE Transactions on Industrial Electronics, vol. 59, pp. 2073-2081, ISSN: 0278-0046, DOI: 10.1109/TIE.2011.2160514.

S. Cicale', L. Albini, F. Parasiliti, M. Villani, "Design of a permanent magnet synchronous motor with grain-oriented electrical steel for direct-drive elevators", ICEM 2012, XX International Conference on Electrical Machines, Marsiglia, September 2012, pp. 1254-1261. ISBN 978-1-4673-0141-1

S.Cicale', L.Albini, S.Fortunati, M.Villani, "Usage of anisotropic electrical steels in rotating machines: advantages and critical points", 5th International Workshop on Magnetism and Metallurgy, Freiberg (Germany), June 2012.

M. Villani, M. Tursini, G. Fabri, L. Castellini "Electromechanical actuator for helicopter rotor damper application", ICEM 2012, XX International Conference on Electrical Machines, Marsiglia, September 2012, pp. 2550-2556. ISBN 978-1-4673-0141-1

E.Chiricozzi, F.Parasiliti, M.Villani, "IE3 high efficiency Induction Motors with aluminum and copper rotor cage: a comparison", World Magnetic Forum, Coiltech 2012 Exibition, Pordenone, September 2012.

M.Tursini, G.Fabri, E.D.Loggia, M.Villani, "Parallel positioning of twin EMAs for fault-tolerant flap applications", Electrical Systems for Aircraft Railway and Ship Propulsion (ESARS), Bologna, 2012, pp. 1-6.

A.M. Gazdac, L.Di Leonardo, L.Mabwe, F.Betin, M.Villani, "Electric circuit parameters identification and control strategy of dual-rotor Permanent Magnet Induction machine", IEEE Electrical Machines & Drive Conference (IEMDC), 2013, pp. 1102-1107.

L.Di Leonardo, F.Parasiliti, M.Tursini, M.Villani, "Transient analysys of PM synchronous motor drives by Finite Element model co-simulation", IECON 2013, 39th annual conference, Vienna, November 2013, pp.6832-6838.

L.Castellini, M.Carmignano, M.D'Andrea, M.Villani, "Brushless PM actuator for metal bending machine", IECON 2013, 39th annual conference, Vienna, November 2013, pp.2642-2647.

M. Villani, M. Tursini, G. Fabri, L. Castellini, "Electromechanical Actuator for Helicopter Rotor Damper Application", IEEE Transactions on Industry Applications, Vol. 50, Issue 2, March-April 2014, pp. 1007-1014, ISSN: 0093-9994.

L.Castellini, M.D'Andrea, M.Villani "Design Optimization of surface PM Synchronous Motors for a Dynamic Focus Adjustment of a Laser Beam", [IEEE International Electric Machines & Drives Conference \(IEMDC\) 2015](#), Chicago, May 2015, pp. 676-682.

A.Ometto, F.Parasiliti, M.Villani, "Permanent Magnet-assisted synchronous reluctance motors for electric vehicle applications", Energy Efficiency in Motor Driven Systems Conference (EEMODS 2015), Helsinki, September 2015.

G.D'Ovidio, C.Masciovecchio, A.Rotondale, M.Villani, "Design of in-wheel motor for "zero-emission" city bus", Proceedings of the 19th Transport Means 2015 International Conference – pp 59-62, ISSN 1822-296X (print), ISSN 2351-7034 (online) Kaunas University of Technology, Lithuania October 2015.

M.Villani, F.Parasiliti, M.Tursini, G.Fabri, L.Castellini, "PM Brushless motor design for helicopter tail rotor", ICEM 2016, XXII International Conference on Electrical Machines, pp.2669-2675, Losanna, September 2016.

M.Tursini, M.Villani, A.Di Tullio, G.Fabri, F.Parasiliti, "Off-line co-simulation of multiphase PM motor drives", ICEM 2016, XXII International Conference on Electrical Machines, pp. 1138-1144, Losanna, September 2016.

M.Tursini, M.Villani, G.Fabri, L.Di Leonardo, "A switched-reluctance motor for aerospace application: design and analysis and results", Electric Power System Research 142, pp.74-83, Elsevier, 2017.

G.Fabri, F.Parasiliti, M.Tursini, M.Villani, L.Castellini, "PM brushless motor for helicopters electric tail rotor drive system", IEEE International Electric Machines and Drives Conference (IEMDC) 2017, pp. 1-7, Miami, 21-24, May 2017.

M.Tursini, M.Villani, A.Di Tullio, G.Fabri, F.Parasiliti, "Nonlinear model suitable for offline cosimulationof fault-tolerant PM motors drives", IEEE Trans. on Industry Applications, vol. 53, no.4, pp. 3719-3729, July/August, 2017.

F.Parasiliti, M.Villani, G.Ranalli, M.Micucci, D.Rossi, "High performance PM-assisted synchronous reluctance motor for electric truck: a case study", Energy Efficiency in Motor Driven Systems Conference (EEMODS 2017), Roma, 6-8 September, 2017.

M.Villani, M.Santececca, "High efficiency Spoke-type PM brushless motor for helicopter tail rotor", Energy Efficiency in Motor Driven Systems Conference (EEMODS 2017), Roma, 6-8 September, 2017.

M.Tursini, A.Credo, G.Fabri, F.Parasiliti, M.Villani, "Assessment of control strategies for synchronous reluctance motors", Energy Efficiency in Motor Driven Systems Conference (EEMODS 2017), Roma, 6-8 September, 2017.

M.Tursini, M.Villani, G.Fabri, S.Paolini, A.Credo, A.Fioravanti, "Sensorless control of a synchronous reluctance motor by finite elements model results", 8th IEEE International Symposium on Sensorless Control for Electrical Drives (SLED 2017), Catania, 18-19 September, 2017.

M.Tursini, M.Villani, G.Fabri, A.Credo, F.Parasiliti, A.Abdelli, "Synchronous Reluctance motor: design, optimization and validation", SPEEDAM 2018 International Symposium on Power Electronics,

Electrical Drives, Automation and Motion, Amalfi, June 2018.

M.Villani, "High performance electric motors for automotive applications: status and future of motors with low cost permanent magnets", 8th Int. Conference on Magnetism and Metallurgy WMM'18, Dresda, June 2016.

L.Castellini, M.D'Andrea, G.Fabri, D.Macera, M.Villani "Design od Synchronous Reluctance machine for a Flywheel-based energy storage system" ICEM 2018, XXIII International Conference on Electrical Machines, pp.2099-2104, Alexandroupoli, September 2018.

M. Villani, M.Tursini, M. Popescu, G. Fabri, A.Credo, L. Di Leonardo "Experimental comparison between Induction and Synchronous Reluctance motor-drive", ICEM 2018, XXIII International Conference on Electrical Machines, pp.1188-1194, Alexandroupoli, September 2018.

M. Villani, F. Parasiliti, M. Santeccecca "High efficiency Line-start Synchronous Reluctance motor for pump and fan applications", ICEM 2018, XXIII International Conference on Electrical Machines, pp.2178-2184, Alexandroupoli, September 2018.

A.Credo, G.Fabri, M.Villani, M.Popescu, "High speed Synchronous Reluctance motor for electric vehicles: a focus on rotor mechanical design", [IEEE International Electric Machines & Drives Conference \(IEMDC\)](#), May 2019, S.Diego (USA).

N.Rivière, G.Volpe, M.Villani, G.Fabri, L.Di Leonardo, M.Popescu, "Design analysis of a high speed copper rotor Induction motor for a traction application, IEEE International Electric Machines & Drives Conference (IEMDC), May 2019, S.Diego (USA).

A.Credo, M.Villani, M.Popescu, N.Rivière, "Synchronous reluctance motors with asymmetric rotor shapes and epoxy resin for electric vehicles IEEE ECCE - Energy Conversion Congress, Baltimora (USA), October 2019.

N.Rivière, M.Villani, M.Popescu, "Optimisation of a High speed copper rotor Induction motor for a traction application", IECON 2019, 45th Annual Conference of the IEEE, Lisboa, October 2019.

G.Venturini, G.Volpe, M.Popescu, M.Villani "Investigation of cooling solutions for Hairpin winding in traction application", ICEM 2020, XXIIII Virtual International Conference on Electrical Machines, 23-26 August, 2020.

M.D'Andrea, G.Di Domenico, D.Macera, L.Di Leonardo, M.Villani, "Brushless DC motor for primary flight surface actuator", ICEM 2020, XXIIII Virtual International Conference on Electrical Machines, 23-26 August, 2020.

M.Carbonieri, L.Di Leonardo, M.Tursini, M.Villani, M.Popescu, "Induction motor performance prediction using static FEA: method description and comparison with Time-Domain approach", IEEE ECCE - Energy Conversion Virtual Congress, 2020, pg. 1351-1356, October 2020.

A.Credo, M.Villani, S.Fortunati, S.Cicalè, L.Albini, "High Performance Synchronous Reluctance motor for electric vehicles – Comparison between NGO e GO electrical steels", 9th Virtual Int. Conference on Magnetism and Metallurgy WMM'20, 3-5 November 2020.

A.Credo, G.Fabri, M.Villani, M.Popescu, "Adopting the topology optimization in the design of high speed synchronous reluctance motors for electric vehicles", IEEE Transaction on Industry Applications, 2020, Vol. 56, Nr.5, pg.5429-5438, DOI: 10.1109/TIA.2020.3007366.

A.Credo, G.Fabri, M.Villani, M.Popescu, "A Robust Design methodology for Synchronous reluctance motors", IEEE Transaction on Energy Conversion, Vol. 35, Nr.4, pg. 2095-2105, DOI [10.1109/TEC.2020.3016567](https://doi.org/10.1109/TEC.2020.3016567).

A.Credo, M.Tursini, M.Villani, C.Di Lodovico, M.Orlando, F.Frattari, "Axial Flux PM in-Wheel Motor for Electric Vehicles: 3D Multiphysics Analysis", Energies 2021, 14(8), 2107; <https://doi.org/10.3390/en14082107>.

A.Credo, M.Villani, N.Rivière, M.Popescu, "Application of Epoxy Resin in Synchronous Reluctance motors with fluid-shaped barriers for e mobility", IEEE Transactions on Industry Applications, Vol. 57 Nr.6, agosto 2021, pg.6440-6452, DOI: 10.1109/TIA.2021.3103826.

M.Carbonieri, N.Bianchi, L.Di Leonardo, M.Tursini, M.Villani, M.Popescu, "Cage Losses in Induction Motors Considering Harmonics: A New Finite Element Procedure and Comparison With The Time-Domain Approach", IEEE Transactions on Industry Applications, Vol.58, n.2, dicembre 2021, pg. 1931-1940, ISSN: 0093-9994, DOI: 10.1109/TIA.2021.3138366.

G.Fabri, A.Ometto, M.Villani, G.D'Ovidio, "A Battery-Free Sustainable Powertrain Solution for Hydrogen Fuel Cell City Transit Bus Application", MDPI *Sustainability* 2022, 14(9), 5401, aprile 2022.

M.Popescu, N.Riviere, G.Fabri, L. Di Leonardo, M.Villani, "Tooling effects on electrical steels: correlation between simulated and experimental results in Inverter fed induction motors", 10th Int. Conference on Magnetism and Metallurgy WMM'22, Milano, June 2022.

A.Credo, F.Parasiliti, M.Tursini, M.Villani, "A fast estimation of the initial rotor position of Synchronous Reluctance Motors", ICEM 2022, XXIX International Conference on Electrical Machines, Valencia, 6-8 settembre 2022.

L.Di Leonardo, F.Parasiliti, M.Villani, M.D'Andrea, C.D'Angelo, M.Nucatola "Permanent Magnet Synchronous Machine for Hybrid Light Aircraft", ICEM 2022, XXIX International Conference on Electrical Machines, Valencia, 6-8 settembre 2022.

A.Credo, G.Fabri, L.Di Leonardo, F.Parasiliti, M.Villani, "Line-Start Synchronous Reluctance Motor: a Reduced Manufacturing Cost Avenue to Achieve IE4 Efficiency Class", IEEE Access 2022, DOI: [10.1109/ACCESS.2022.3208154](https://doi.org/10.1109/ACCESS.2022.3208154).

A.Credo, M.Villani, I.Petrov, J.Pyrhönen, "Impact of manufacturing stresses on multiple-rib Synchronous Reluctance Motor performance", IEEE Transactions on Industry Applications, Print ISSN: 0093-9994, Online ISSN: 1939-9367, 2022, Digital Object Identifier: [10.1109/TIA.2022.3207117](https://doi.org/10.1109/TIA.2022.3207117).

A.Credo, G.Fabri, M.Villani, M.Popescu, "Adoption of the Synchronous Reluctance Motor in Electric Vehicles: a Focus on the Flux Weakening Capability", IEEE Transactions on Transportation Electrification, 2023, ISSN: 2332-7782, Digital Object Identifier: [10.1109/TTE.2022.3204435](https://doi.org/10.1109/TTE.2022.3204435).