WEMDCD 2025

9 - 10 April 2025, Valletta, Malta

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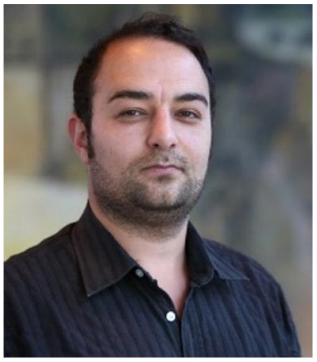
General Chairs' Welcome Message

Dear Colleagues, Friends, and Esteemed Guests,



Prof. Michael Galea
University of Malta

It is our pleasure to welcome you to the 7th edition of the IEEE Workshop on Electrical Machines Design, Control, and Diagnostics (WEMDCD 2025), taking place on 9-10 April 2025 in Valletta, Malta. WEMDCD has established itself as a premier forum for sharing research and technological advancements in electrical machines and drives. This year's edition highlights the role of electrification in sustainable transportation and industrial applications, addressing the growing need for energy efficiency and intelligent automation in sectors such as automotive, aerospace, and maritime industries.

The workshop will commence with pre-conference seminars on 8 April, followed by a meticulously curated technical programme over two days. Attendees can expect keynote presentations from renowned experts, oral and poster sessions, and panel sessions led by industry leaders. Special focus will be given to the topics of electrical machine design and modelling, advanced control strategies for electrical drives, reliability and health monitoring of machine systems, and the development of sustainable and high-efficiency machines and drives.

Prof. Stefano Nuzzo
University of Modena and Reggio Emilia, Italy

We take pride in supporting students and early-career researchers, offering them opportunities to contribute fresh perspectives. Through the WEMDCD Alessandro Costabeber Best Student Paper Award, outstanding research achievements will be honoured, while the Women in Transport Best Student Paper Award will promote female representation in engineering. We are also strongly committed to organising a sustainable forum with a reduced environmental footprint, aligning with global sustainability efforts, integrating digital solutions and sourcing from local suppliers.

We would like to extend our gratitude to all contributors—authors, reviewers, speakers, committee members, sponsors, and attendees—whose unwavering dedication continues to strengthen WEMDCD as a successful platform for knowledge dissemination and technological progress. We encourage you to engage in discussions, explore collaborations, and take advantage of the networking opportunities. Beyond the sessions, we also invite you to tour the picturesque landscapes of Valletta and experience the cultural background in addition to the historical richness that Malta has to offer.

Once again, we warmly welcome you to Malta and look forward to an insightful, inspiring, and rewarding conference together.

Yours sincerely,

Michael Galea & Stefano Nuzzo

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Programme at a glance

Tuesday 08th April 2025	
14.30-17.00	WEMDCD 2025 Registration Open
14:45-17:50	Pre-conference Seminars
18:00-20:00	Welcome Reception

Wednesday 09th April 2025	
07:30	WEMDCD 2025 Registration Open
08:30-08:40	Conference Opening by General Chairs
08:40-09:20	Keynote 1
09:20-09.45	Coffee break
09:45-11.50	Speaker Session 1 – Electrical Machine Design and Modelling 01
11.50-13:00	Lunch & Poster Session 1
13:00-13:40	Keynote 2
13.40-15.20	Speaker Session 2 – Electrical Drives and their Control 01
15:20-15:45	Coffee break
15.45-17:25	Speaker Session 3 – Sustainable Machines and Drives for Industrial and Transport Applications 01
17:30-18:15	IES EMTC Industrial Panel 1
18.15-22:45	Pre-dinner activity & Formal Dinner

Thursday 10th April 2025	
08:15-09:00	Keynote 3
09:00-10:15	Speaker Session 4 – Sustainable Machines and Drives for Industrial and Transport Applications 02
10:15-10:40	Coffee break
10.40-12:20	Speaker Session 5 – – Electrical Machine Design and Modelling 02
12:20-13:30	Lunch & Poster Session 2
13.30-14.15	IES EMTC Industrial Panel 2
14:15-15:55	Speaker Session 6 – Electrical Drives Reliability and Monitoring 01
15:55-16:15	Coffee break
16.15-17.55	Speaker Session 7 – Electrical Drives and their Control 02

18:00-18.30	Paper Award Ceremony and Workshop closing

Keynote Speeches

Keynote 1: "Advanced Battery Management & Control Solutions for Motive Power Applications"

Presenter: Malcolm Tabone - Abertax Technologies

Abstract

Battery systems are at the core of modern energy storage and mobility solutions, making their effective management crucial for safety, performance, and lifetime. The presentation highlights key aspects of battery monitoring, requirements for different battery chemistries, the importance of data acquisition and high-speed logging in motive applications. The appropriate battery design and its control integration with the overall management of the system are necessary to meet the demands of high-performance drives. Battery monitoring is vital for ensuring operational reliability, safety, and efficiency. Advanced monitoring systems provide real-time monitoring of parameters such as voltage, current, temperature, and state of charge (SOC), enabling real-time adaptive control strategies. These systems also optimize energy utilization by analysing historical trends to improve charging strategies and extend battery life. Respecting battery chemistry is fundamental to maintaining safety and performance. Different chemistries, such as lead acid, lithium-ion and the emerging sodium-ion technology, require specific charging protocols and thermal management to prevent degradation or hazards like thermal runaway. Adherence to these requirements ensures long-term stability and efficiency. Battery communication with drives and chargers is essential for system integration. A robust Battery Management System (BMS) facilitates seamless interaction between components, ensuring optimal charging rates, fault detection, and cell balancing. This communication is critical for ensuring the best possible range while providing the maximum possible power demand in electric drive applications.

The presentation aims to provide a comprehensive overview of advancements in battery management technologies. Attendees will gain insights into how these systems enhance efficiency, reliability, and sustainability across various applications, addressing key challenges such as performance optimization and durability concerns.

Biography

Malcolm Tabone graduated in electrical engineering in 2003, followed by a M.Sc. in electrical engineering at the University of Malta. He then joined Abertax Technologies in the capacity of a technical support engineer, where he was involved in the design and testing of the company's electronic products and gave support to production. He designed and programmed a number of jigs and automation machines that are essential to the assembly of company products today. Since 2009, he has also been a visiting lecturer at the Faculty of Engineering of the University of Malta. In 2016, he was appointed as Research Director and, in 2019, Chief Executive Officer at Abertax Technologies Ltd.

Alongside his management commitments, Malcolm remains actively involved with technology and its advancement. He actively contributes to new concepts and products and evaluates new research tools and emerging technologies.

Keynote 2: "Importance of magnetic measurements in optimization of design and manufacturing processes of electric motors"

Presenter: Dr Łukasz Mierczak - Brockhaus Polska

Abstract

Accurate design and prediction of electric motor performance is not a trivial task. Motor design engineers make use of advanced numerical and analytical methods for electromagnetic and thermal analysis, and still find considerable differences in efficiency of modelled and manufactured machines.

One of the primary sources for this mismatch is the inaccuracy in stator lamination magnetic properties, such as BH curve and power loss, which are used as input data for calculating flux linkages of the coils and heat dissipation, and consequently determining the main motor parameters including torque and operating temperature.

Typically, the magnetic properties implemented in motor modelling are provided by the material supplier based on the Epstein frame measurements, according to the International Standard IEC 60404-2. The effects of processing of the magnetic materials during motor manufacturing are neglected which gives rise to uncertainty in prediction of motor performance. In this presentation the results from industrial case studies involving advanced magnetic measurements will be presented, including characterization of stress sensitivity of soft magnetic materials, optimization of stamping and stacking methods in production of stator cores, as well as evaluation of manufacturing technologies for mitigation of eddy current loss in permanent magnets.

Moreover, the presentation will explore the direct correlation between the deterioration in magnetic properties and the inferior performance of EV IPM electric motor to emphasize the importance of maintaining the quality of stator cores to ensure optimal powertrain performance.

Biography

Dr Łukasz Mierczak is a seasoned expert in electrical engineering with a PhD from Cardiff University, UK. He currently serves as the Managing Director of Brockhaus Polska in Częstochowa, Poland, where he oversees operations and innovations in magnetic measurement technology. With extensive experience as a Principal R&D Engineer at Brockhaus Measurements (2017-2023), he has spearheaded advancements in measurement technologies for soft and hard magnetic materials.

Earlier in his career, Dr Mierczak worked as a Motor Design Engineer at E-propelled in Cardiff, focusing on the electromagnetic and thermal design of electrical machines. His academic tenure as a Research Assistant at Cardiff University's Wolfson Centre for Magnetics involved developing magnetic sensors and methods for non-destructive evaluation of critical components, such as helicopter parts and railway systems. Dr Mierczak blends technical acumen with leadership, driving progress in magnetic materials and electrical engineering industries.

Keynote 3: "Ferrari's journey towards electrification: Challenges, opportunities, methodologies to further push the boundaries"

Presenter: Giovanni Lo Calzo - Ferrari Spa

Abstract

Ferrari's journey towards electrification merges cutting-edge technology with the brand's legendary performance and luxury. Beginning in 2009 with the introduction of the Kinetic Energy Recovery System (KERS) in Formula 1, Ferrari has progressively advanced its electrification strategy, achieving significant milestones shared during the Capital Markets Day 2022 and culminated so far in the presentation to the public of F80 in 2024.

To accomplish its ambitious goals, Ferrari has redefined its approach to car design and engineering. The integration of new mechanical solutions for chassis, adherence to updated homologation standards such as WLTP and CLTC, and the incorporation of advanced functionalities tailored to new markets demonstrate Ferrari's commitment to innovation. Enhanced design methodologies have been adopted, transitioning from systems integration to holistic systems design, ensuring that each component is optimized for overall system performance rather than local optima.

This keynote will address the challenges faced during this journey and the opportunities unlocked by this technology, giving an overview of the methodologies Ferrari has adopted to navigate the complex landscape of electrification.

Biography

Giovanni Lo Calzo received his Master's degree with honours and his PhD degree from the University of ROMA TRE, Rome, Italy, respectively, in 2010 and 2015. From 2010 to 2011, he was a Research Assistant at the University of Roma Tre. In 2015, he joined the Power Electronics, Machine and Control (PEMC) Group at the University of Nottingham, UK, as a Research Fellow, focusing on the modelling, design and control of power electronics converters and on the design of high TRL industrial prototypes. In 2017, he moved to the industry to work for Dyson Ltd within their innovative EV development program. Since 2018, he has been with Ferrari Spa, leading the team in charge of HW design of power electronics components for XEVs and future BEVs.

Giovanni has authored and co-authored more than thirty publications in international journals/conference proceedings and holds 10 patents on power electronics converters and methodologies applied to the automotive field.

Conference Programme

IMPORTANT NOTICE: the scheduled times are expressed as Central European Summer Time (CEST) = Coordinated Universal Time (UTC) + 2h due to daylight savings time being in effect. A useful tool to convert the time in other time zones is here.

Tuesday 08th April 2025		
14.30-17.00	WEMDCD 2025 Registration Desk Open	
14.45-17.50	Pre-conference Seminars – Sponsored by H2020 MSCA-RISE Project DORNA – Chair: Stefano Nuzzo	
14.45-15.00	Pre-conference Seminars Opening	
15.00-15.30	Seminar 1: "Enabling industrial digitalization across applications and segments"	**Dmitry Svechkarenko** R&D Team Manager ABB Corporate Research, Västerås, Sweden
15.30-16.00	Seminar 2: "Case Studies of Control Systems Evolution: Modulators, Regulators, Modifications"	**Arkadiusz Kaszewski** Warsaw University of Technology, Warsaw, Poland
16.00-16.20	Coffee Break	
16.20-16.50	Seminar 3: "Modern technics used for research and development of Electrical Power Train"	**Marcin Szlosek** Motion Business R&D Development Manager ABB PL, Krakow, Poland
16.50-17.20	Seminar 4: "Development process of electrical machines for Aircraft"	**Tadashi Sawata** Senior Technical Fellow, Motors/Electromagnetics Collins Aerospace, Shirley, UK
17.20-17.50	Seminar 5: "A vision of modern condition monitoring for electrical machines and drives"	**Gerard Capolino** University of Picardie "Jules Verne", Amiens, France

18.00-20.00	WEMDCD 2025 Welcome Reception

Wednesday 09th April 2025		
07:30	WEMDCD 2025 Registration Desk Open	
08.30-08.40	Conference Opening by General Chairs	
08:40-09:20	Keynote 1 – Chair: Michael Galea	
	Keynote 1: "Advanced Battery Management and Control Solutions for Motive Power Applications"	**Malcolm Tabone** CEO, Abertax Technologies Ltd, Malta
09.20-09.45	Coffee Break	
Speaker Session 1 – Electrical Machine Design and Modelling 01 – Chair: Francesco Parasiliti		
09:45-10.10	WEMDCD25-00090 - Challenges of Iron losses Characterization, Modelling, and Computation	**Anouar Belahcen** Aalto University, Finland
10:10-10.35	WEMDCD25-00058 - Losses in Axial Flux Permanent Magnet Synchronous Machine for Electric Vehicles Propulsion Systems	Bogdan Butnariu, Abderrahmane Rebhaoui, **Claudia Martis** Technical University of Cluj-Napoca, Romania
10:35-11.00	WEMDCD25-00098 - Design of Continuous Hairpin Winding for Multi-phase MW-Class Electric Aircraft Propulsion	Hailin Huang, Tianjie Zou, Anh Thanh Huynh, Tao Yang, David Gerada, **Chris Gerada** University of Nottingham, UK
11.00-11.25	WEMDCD25-000032 - Cost Performance of Using Surrogate Models in GA Optimization for Machine Designs	Koji Tani, Shogo Asahino, Hirojuki Sano, **Takashi Yamada** JSOL Corporation, Japan
11.25-11.50	WEMDCD25-000108 - Variable Temperature PMSM dynamic model based on Spline Interpolation of Coenergy Map	Alessandro Capitanio, Stefano Nuzzo, Giacomo Sala, Davide Barater, **Giovanni Franceschini** University of Modena and Reggio Emilia, Italy
11.50:13.00	Lunch break & Poster Session 1	
	Poster Session 1 - Chairs: Fabio Tinazzi & Luca Papini	

13.00-13.40	Keynote 2 – Chair: Stefano Nuzzo	
	Keynote 2: "Importance of magnetic measurements in optimization of design and manufacturing processes of electric motors"	**Lukasz Mierczak** Managing Director, Brockhaus Polska, Brockhaus Group
Speaker Session 2 - Electrical Drives and their Control 01 – Chair: Jose Antonino Daviu		
13:40-14.05	WEMDCD25-000119 - Direct Flux Control: a viable torque control approach for three-phase and multi-phase motor drives for transportation electrification	Sandro Rubino, Luisa Tolosano, **Radu Bojoi** Politecnico di Torino, Italy
14.05-14.30	WEMDCD25-000052 – Electromechanical Oscillations Angle Compensation Technique for Sensorless Permanent Magnet Motor Drive	**Athanasios Sarigiannidis**, Nikolaos Kampouroglou, Nektarios Karakasis, Nikolaos Tsakalakis RoboteQ - Nidec Motor Corporation, Greece
14:30-14.55	WEMDCD25-000078 - Diagnostics and Compensation of Phase Current Sensor Faults in PMSM: A Review	Ciro Attaianese, Matilde D'Arpino, Mauro Di Monaco, **Luigi Pio Di Noia** Ohio State University, USA
14.55-15.20	WEMDCD25-000024 - Virtual-Vector-Based Model Predictive Control with Deadbeat Solution for Symmetrical Six-Phase Induction Motors	**João Serra**, Fernando Bento, Antonio J. Marques Cardoso CISE—Electromechatronic Systems Research Centre, University of Beira Interior, Portugal
15:20-15:45	Coffee Break	
Speaker Session 3 – Sustainable Machines and Drives for Industrial and Transport Applications 01 – Chair: Antonios Kladas		
15:45-16.10	WEMDCD25-000008 - Analysis and Design Remarks of Variable Flux Reluctance Motors	**Nicola Bianchi** University of Padova, Italy
16:10-16.35	WEMDCD25-000126 – Variable Flux Reluctance Machines for Heavy-duty Vehicle Applications	Doga Ceylan, Konstantin Boynov, **Elena Lomonova** Eindhoven University of Technology, The Netherlands
16:35-17.00	WEMDCD25-000101 - Vessel considerations to support drive design for small harbour transport boats	**Joseph Cilia**, Neville Azzopardi, Michael Galea, Tonio Sant University of Malta, Malta
17.00-17.25	WEMDCD25-000120 - A Comparative Study of Single-Rotor and Dual-Rotor Radial Flux Electric Machines for Central-Drive BEVs	**Shafigh Nategh**, Andreas Carlsson, Aldo Boglietti SEDRIVE AB, Sweden
17.30-18.15	IES EMTC Industrial Panel 1: Challenges in Cooling and Insulation Design of Electric Machines for Heavy Vehicles – Chair: Michael Galea	

18:15-22.45	Pre-dinner Activity & Formal Dinner

Thursday 10th April 2025		
08:15-09:00	Keynote 3 – Chair: Stefano Nuzzo	
	Keynote 3: Ferrari's journey towards electrification: Challenges, opportunities, methodologies to further push the boundaries	**Giovanni Lo Calzo** Team leader of power electronics HW design Ferrari SPA
Speaker Session 4 – Sustainable Machines and Drives for Industrial and Transport Applications 02 – Chair: Giampaolo Devito		
09:00-09.25	WEMDCD25-000115 - The Impact of Metal Additive Manufacturing Technology on Electrical Machine Design: A Review	Salar Koushan, **Ayman EL-Refaie** Marquette University, USA
09:25-09.50	WEMDCD25-000082 - Efficiency Mapping of Electrically Excited Synchronous Motors with Different Control Strategies	**Federica Graffeo**, Sandro Rubino, Matias Jimenez, Silvio Vaschetto, Alberto Tenconi Politecnico di Torino, Italy
09:50-10.15	WEMDCD25-000029 - On the Insulation Performance of a Hermetically Sealed, Process-Cooled Motor-Compressor Exposed to Water-Saturated Natural Gas Environments	**James Borg Bartolo**, Gunnar Berg-Karlsen, Jeremy Lepelley, Svend Tarald Kibsgaard MAN Energy Solutions AG, Switzerland
10.15-10.40	Coffee Break	
Speaker Session 5 – Electrical Machine Design and Modelling 02 – Chair: Claudia Martis		
10:40-11.05	WEMDCD25-000014 - Efficiency Optimization and Modeling of the Air Gap Permeance of Low-Voltage Induction Motors Using Soft Magnetic Slot Closing Material	**Florian Kirchner**, Andreas Kremser Innomotics GmbH
11:05-11.30	WEMDCD25-000013 - Performance Improvement of Switched Reluctance Machines Through Appropriate Design Choices	**Vincenzo Madonna**, Cesare Maria Meano, Ken Friis Hansen Dumarey Automotive Italia S.p.A., Italy
11:30-11.55	WEMDCD25-000118 - Advanced cooling techniques for permanent magnet motors in transportation electrification applications	Antonios Sideris, Ioannis Alonistiotis, Aggelos Argyriou, Georgios Sakkas, **Antonios Kladas** National Technical University of Athens, Greece
11.55-12.20	WEMDCD25-000050 - Structural Dynamic Behaviour of a Linear Transverse Flux Machine	**Fabian Kodalle**, Jannik Ulbrich, Amir Ebrahimi University of Bremen, Germany
12.20:13.30	Lunch break & Poster Session 2	
	Poster session 2 - Chairs: Fabio Tinazzi & Luca Papini	

13.30-14.15	IES EMTC Industrial Panel 2: Challenges in Design and Optimization of Electric Machines – Chair: Shafigh Nategh	
Speaker Session 6 - Electrical Drives Reliability and Monitoring 01 – Chair: Gerard Capolino		
14:15-14.40	WEMDCD25-000079 - Fault Detection in Closed-Loop Controlled Electrical Motors: A Review	Francesca Muzio, Lorenzo Mantione, **Lucia Frosini**, Daniel Morinigo-Sotelo, Marcello Minervini; Tamas Garcia-Calva University of Pavia, Italy
14.40-15.05	WEMDCD25-000044 - Condition Monitoring of Electric Motors based on Multiquantity Analysis under Transient Regimes	**Jose Antonino Daviu**, Jose E. Ruiz-Sarrio, Alfredo Quijano-Lopez, Vicente Fuster-Roig, Pedro Llovera-Segovia, Isabel Seguí Verdú Universitat Politecnica de Valencia, Spain
15.05-15.30	WEMDCD25-000069 - Insulation technologies for state-of-the-art electrical machines used in transport electrification	**Andrea Cavallini**, Paolo Seri, Iacopo Iannarelli, Iago Martinez University of Bologna, Italy
15.30-15.55	WEMDCD25-000100 - Development of Sustainable Slot Liners for 800 V+ Oil-cooled Electrical Machines for Passenger Cars	**Md Jahirul I.**, Patrick Altmann, Thomas Hammarström, Shafigh Nategh, James Bonnett, Yuriy Serdyuk, Andreas Carlsson, Victrex
15.55-16.15	Coffee Break	
Speaker Session 7 – Electrical Drives and their Control 02 – Chair: Antonio Cardoso		
16.15-16.40	WEMDCD25-000057 - Exploiting electric drives for battery monitoring and inverter devices heat stress management in EVs	**Giacomo Scelba**, Luigi Danilo Tornello, Antonio Testa, Tommaso Scimone, Salvatore Foti, Giuseppe Scarcella, Mario Cacciato University of Catania, Italy
16.40-17.05	WEMDCD25-000027 - Inverter Switching Loss Optimization for PMSM Drives Based on Customer-designed Finite Control Set Model Predictive Control	Jun Yang, **Tianxiao Yang**, Yimeng Li, Wen-Hua Chen Loughborough University, UK
17:05-17.30	WEMDCD25-000028 - A Single Current Sensor Reconstruction PMSM Drive Based on Shift PWM Compensation Considering Saturation and Sampling Offset	Shuo Wang, Vasyl Varvolik, John Xu, Abraham M. Alcaide, Yuli Bao, **Giampaolo Buticchi** University of Nottingham Ningbo, China
17.30-17.55	WEMDCD25-000111 - Continuous Control Set Model Predictive Torque Control of Electrically Excited Synchronous Motors	**Fabio Tinazzi**, Mauro Zigliotto, Niklas Monzen, Christoph Hackl, Ismaele Diego De Martin University of Padova, Italy
18:00-18.30	Paper Award Ceremony and Workshop Closing	

Poster Session 1

Wednesday 09th April 2025		
11:50-13:00	Electrical Drives Reliability and Monitoring 02	
WEMDCD25-000001	Comprehension and limitations of different types of data-driven condition monitoring systems for electrical machines in the context of bearing condition monitoring	Michel Lehmann, Andreas Möckel TU Ilmenau, Germany
WEMDCD25-000006	Enhanced Detection of Demagnetization in Direct-Drive Wind Turbine Generators Using eMIST and Machine Learning	Qiuyi Chen, Panagiotis Tsilifis, Jaime Renedo Anglada GE Vernova Advanced Research, USA
WEMDCD25-000012	Investigation of Factors Influencing the End-of-Line Partial Discharge Testing of Electrical Machines	Andreas Rauscher, Peer Stenzel, Christian Endisch Technische Hochschule Ingolstadt, Germany
WEMDCD25-000018	Wideband Frequency Response Analysis for Condition Assessment of Turn Insulation Degradation Faults in Inverter-Fed Motors	Muhammad Usman Sardar, Toomas Vaimann, Lauri Kütt, Bilal Asad, Ants Kallaste, Raul Land Tallinn University of Technology, Estonia
WEMDCD25-000019	Radial Force Reconstruction in Permanent Magnet Synchronous Machines Using Air Gap Flux Density Measurements	Alexander Pfannschmidt, Ingo Hahn Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
WEMDCD25-000026	Hybrid fault detection and diagnosis approach of power connections for induction machines	Mireya Cabezas, Izaskun Sarasola, David Gonzalez Jimenez, Jon del Olmo Larrañaga,J avier Poza Mondragon Unibertsitatea, Spain
WEMDCD25-000034	On the Effect of Pulse Voltage Frequency During Insulation Electrical Endurance Tests at 200 mbar Pressure	Yatai Ji, Paolo Giangrande, Pinjia Zhang, Michael Galea, Jing Zhang, Xuanming ZHOU, Weiduo Zhao Tsinghua University, China
WEMDCD25-000045	A Precise Modeling and Performance Enhancement of the Pole Drop Test for Wound Rotor Synchronous Machines	Saeed Afrandideh, Edmund Marth, Gerd Bramerdorfer Johannes Kepler Universität Linz: JKU, Austria
WEMDCD25-000073	Eccentricity Fault Diagnosis in Permanent-Magnet Synchronous Motors Using the Stray Flux Vector	Antonio Femia, Jose E. Ruiz-Sarrio, Giacomo Sala, Jose Antonino Daviu, Luca Zarri University of Bologna, Italy

11::50-13:00	Electrical Machine Design and Modelling 03	
WEMDCD25-000004	Qualitative estimation of energy conversion efficiency of winding schemes for electrical machines	Ingo Hahn Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
WEMDCD25-000009	Design optimization of immersion cooled electric motor by CFD simulations	Steven Vanhee, Jaywant Pawar, Frederik Desmet, Jasper Nonneman, Michel De Paepe Ghent University, Belgium
WEMDCD25-000016	Optimal Insulation Thickness Design for Partial Discharge-Free Operation in Automotive and Aerospace Electrical Machines	Hadi Naderiallaf, Michele Degano, Christopher Gerada The University of Nottingham, UK
WEMDCD25-000022	Comparative Study on Torque Ripple Reduction Techniques for an Automotive Permanent Magnet Motor without Skew	Beñat Arribas, Gaizka Almandoz, Aritz Egea, Javier Poza, Gaizka Ugalde, Fernando Garramiola Mondragon Unibertsitatea, Spain
WEMDCD25-000023	Optimisation of an Automotive Permanent Magnet Motor with Low Coercivity Recycled Magnets considering Demagnetisation	Beñat Arribas, GAIZKA ALMANDOZ, Aritz Egea, Javier Poza, Fernando Garramiola, Gaizka Ugalde Mondragon Unibertsitatea, Spain
WEMDCD25-000030	Research on Performances of Three-phase Brushless DC Motors in Different Driving Methods	Ling Luo, Wantong Duan, Shangyu Ren, Cheng Li Northwestern Polytechnical University, China
WEMDCD25-000035	A Comparison Study in Two PMaSynRels with Different Sintered Ferrite Shapes	Yuli Bao, Shuo Wang, Mauro Di Nardo, Giampaolo Buticchi, Michele Degano, Zhenyao Xu University of Nottingham, UK
WEMDCD25-000046	Analytical Vibration model of Stator Inter-turn Short Circuit and Eccentricity in a Synchronous Generator at different loading conditions	Thien- Phuoc Nguyen, Khang Huynh, Kjell Robbersmyr University of Agder, Norway
WEMDCD25-000049	Understanding Power Factor Limitations in Transverse Flux Machines: A Frozen Permeability Analysis of Magnetic Flux Linkage	Benedikt Kaiser, Adrian Schäfer, Andreas Gneiting, Nejila Parspour Institute of Electrical Energy Conversion, University of Stuttgart, Germany
WEMDCD25-000080	X-ray Computed Tomography Derived Turn Bundle Shapes and Transposition in Volume Manufactured Multistrand Random Windings	Joshua Hoole, Elizabeth Martin-Silverstone, Philip Mellor, Nick Simpson University of Bristol, UK

WEMDCD25-000084	Influence of MTPA Trajectory Evaluation on Synchronous Machines Performance	Giada Sala, Simone Ferrari, Gianmario Pellegrino, Claudio Bianchini, Matteo Davoli University of Modena and Reggio Emilia, Italy
WEMDCD25-000104	Effect of Annealing and Building Direction on the Magnetic Behavior of Additively Manufactured FeCo49V2 Alloy	Nicola Giannotta, Giada Sala, Gabriele Puccio, Bastian Kallenbach, Claudio Bianchini, Stefano Nuzzo University of Modena and Reggio Emilia, Italy
WEMDCD25-000109	Design of Asymmetric Permanent Magnet Rotor for Efficient Material Use in a PMSM for High Performance Automotive Applications	Andreas Carlsson, Tony Persson, Christian Sandström, Christian Wolrath, Shafigh Nategh Polestar, Sweden
WEMDCD25-000114	Effect of Stray Inductance on the Characterization of Low Permeability Iron Powders in Ring-shaped Specimens	Mohammad Torabi Shahbaz, Daniel Wockinger, Gerd Bramerdorfer, Johannes Kepler University Linz, Austria

11::50-13:00	Electrical Drives and their Control 03	
WEMDCD25-000002	Model Predictive Flux Weakening Controller for Asymmetrical Dual Three-Phase PMSM Drives	Adriano Navarro, Josu Jugo, Edorta Ibarra, Iñigo Kortabarria University of the Basque Country (UPV/EHU), Spain
WEMDCD25-000010	A Fully Sliding Mode Sensorless Control of a PMSM for a Household Appliance	Alessio Beato, Elenonora Brasili, Luigi Fagnano, Gianluca Ippoliti, Giuseppe Orlando Università Politecnica delle Marche, Italy
WEMDCD25-000067	Finite-Control-Set Model-Predictive Control of Open-End Winding Synchronous Reluctance Motor Drives	Filippo Gemma, Jacopo Riccio, Giulia Tresca, Oriana Benfatto, Pericle Zanchetta University of Pavia, Italy
WEMDCD25-000038	A Tunneling Magnetoresistance-Based Multi-Phase Current Sensor for High-Performance Drives	Qilin PENG, Hailin Huang, Jordon Dobson, Tianxiang Yin, Ying Li, Giampaolo Buticchi University of Nottingham Ningbo, China
WEMDCD25-000042	Inductance and Self-Sensing Capabilities Computation for Synchronous Reluctance Motors based on Coenergy Model	Matteo Berto, Ludovico Ortombina, Luigi Alberti Università degli Studi di Padova, italy
WEMDCD25-000093	System level, comparative loss evaluation of interior permanent magnet drive with traditional and predictive control strategies	Filippo Savi, Gregorio Cutuli, Stefano Nuzzo, Davide Barater University of Modena and Reggio Emilia, Italy

11::50-13:00	Sustainable Machines and Drives for Industrial and Transport Applications 03	
WEMDCD25-000005	A Semi-Supervised Variational Autoencoder for Fault Detection of Low-Severity Inter-Turn Short-Circuit in PMSMs	Mingda Zhu, Du Nguyen, Peihua Han, Khang Huynh, Jing Zhou University of Agder, Norway
WEMDCD25-000053	Design and Implementation of a Test Bench for Regenerative Braking Evaluation on E-bike Motor	Marcello Minervini, Paolo Giangrande, Filippo Cortinovis, Lorenzo Mantione, Davide Previtali University of Bergamo, Italy
WEMDCD25-000065	Electric Vehicle Performance Analysis under Varying Wind and Road Slope Conditions	Ahmed Hebala Arab Academy for Science and Technology and Maritime Transport, Egypt
WEMDCD25-000071	Structural Investigations on Yokeless Electrically-Excited Segmented Armature Axial Flux Motor	Valerio Mangeruga, Andrea Piergiacomi, Shafigh Nategh, Philippe Farah, Stefano Nuzzo University of Modena and Reggio Emilia, Italy
WEMDCD25-000072	Performance Improvement of Induction Machines for Automotive Application	Angelo Boceda, Giovanni Maria Foglia, Tommaso Bertoncello Politecnico di Milano, Italy
WEMDCD25-000077	Comparison between Aluminum and Copper Hairpins on the Torsional-Flexural Instability Phenomenon in the Bending Process	Pietro Falletta, Gregorio Cutuli, Saverio Giulio Barbieri, Valerio Mangeruga, Tianjie Zou, Stefano Nuzzo University of Modena and Reggio Emilia, Italy
WEMDCD25-000103	Brushless Excitation Solutions for Wound-Field Synchronous Motors in Electric Vehicles: a Survey	Murtaza Ali Khooharo, Luca Papini, Paolo Bolognesi University of Pisa, Italy

Poster Session 2

Thursday 10th April 2025		
12:20-13:30	Electrical Drives Reliability and Monitoring 03	
WEMDCD25-000020	Enhanced Electrical Signature Analysis (e-ESA) for Offshore Wind Permanent Magnet Generators	Jaime Renedo Anglada, Weizhong Yan, Bojun Feng, Manoj Shah GE Vernova Advanced Research, USA
WEMDCD25-000047	Long term Performance of Fibre Bragg Grating Sensors for In Situ Thermal Monitoring of Random Wound Electric Machine Coils	Zhanan Ao, Paul M. Tuohy, Sinisa Durovic, Graham Bruce University of Manchester, UK
WEMDCD25-000074	Fault Tolerance of Dual-Three-Phase Drives: Tuning of the Auxiliary Current Regulators and Open-Phase-Fault Operation	Giacomo Sala, Gabriele Antonino Cagliari, Antonio Femia, Luca Vancini, Gabriele Rizzoli, Luca Zarri, Angelo Tani University of Bologna, Italy
WEMDCD25-000075	Fault-Tolerant Architectures For Six-Phase Permanent Magnet Electrical Machines	Gabriele Antonino Cagliari, Giacomo Sala, Antonio Femia, Michele Mengoni, Angelo Tani, Leonardo Vita, Fabio Crescembini University of Bologna, Italy
WEMDCD25-000076	Slot Opening Influence on Short Circuit Current: a Sensitivity Analysis	Andrea Tinti, Gregorio Cutuli, Stefano Nuzzo, Giacomo Sala, Davide Barater, Giovanni Franceschini University of Modena and Reggio Emilia, Italy
WEMDCD25-000099	Synthetic Data-Driven Detection of Broken Rotor Bars in Induction Machines Under Adjusted Noise Level	Nurjahan Amin Nuha, Md Tanbir Siddik Injam, Nada El Bouharrouti, Ahmed Hemeida, Karolina Kudelina, Muhammad Usman Naseer, Anouar Belahcen Aalto University, Finland
WEMDCD25-000102	Advanced startup current analysis for the detection of broken outer bars in dual-cage induction motors considering bar materials	Carlos Madariaga, Felipe Santacruz, Jose E. Ruiz-Sarrio, Cesar Gallardo, Juan Tapia, Jose Anton Daviu University of Concepcion, Chile
WEMDCD25-000112	Investigation of extracting a transfer function from transient signals during switching operations of inverters for on-line monitoring of electrical machines	Hujun Peng, Yue Yu, Simon Steentjes RWTH Aachen University, Germany

12:20-13:30	Electrical Machine Design and Modelling 04	
WEMDCD25-000051	Measurement and Modelling of the No -Load Losses of a DSSR-AFMM with Round and Flat Wires: Experimental Separation of Ion Stator, Rotor and AC Losses	Abdelli Abdenour, Gianluca Zito, Emmanuel Godefroy, Adrien Gilson IFPEN, France
WEMDCD25-000060	Starting Performance of Large Grid-Fed Solid-Rotor Salient-Pole Synchronous Motors for the Oil&Gas Industry: Simulation Challenges and Factory Test Experiences	Matteo Olivo, Alberto Tessarolo, Fabio Luise University of Trieste, Italy
WEMDCD25-000062	Pareto Fronts in the Optimization of Fractional Slot Concentrated Windings for Rotor Loss Reduction in Surface Permanent Magnet Machines	Matteo Olivo,Alberto Tessarolo,Cesare Ciriani University of Trieste, Italy
WEMDCD25-000063	Thermal Analysis of a Rotor Oil Jet Cooled Electric Motor with Hairpin Windings	Steven Vanhee, Jaywant Pawar, Frederik Desmet, Jasper Nonneman, Michel De Paepe Ghent University, Belgium
WEMDCD25-000066	Effect of Axial Slits on High-Speed Axially Laminated Rotor of Synchronous Reluctance Machine	Maksim Sitnikov, Julien Taurines, Anouar Belahcen Aalto University, Finland
WEMDCD25-000070	Look-Up Table Based Reduced Order Model of Synchronous Motors for Digital Twin Applications	Lorenzo Mantione, Gabriele De Boni, Lucia Frosini, Marcello Minervini University of Pavia, Italy
WEMDCD25-000081	Inlet Placement Influence on Thermal Performance of an Oil-Cooled Traction Motor	Michelangelo Raimondo, Gabriele Puccio, Stefano Nuzzo, DAVIDE BARATER Università di Modena e Reggio Emilia, Italy
WEMDCD25-000087	Structural and Electromagnetic Rotor Topology Optimization of a PM-Assisted Synchronous Reluctance Motor Using Commercial Software	Francesco Puglisi, Mauro Giacalone, Giampaolo Devito, Nicolò Lodini, Sara Mantovani University of Modena and Reggio Emilia, Italy
WEMDCD25-000091	Optimizing Multiphase Hairpin Windings with a Two-Level Approach for High-Efficiency and High-Power Density Aircraft Electric Propulsion	Anh Thanh Huynh, Hailin Huang, Tianjie Zou, David Gerada, Tao Yang, Chris Gerada University of Nottingham, UK
WEMDCD25-000092	Exploring Inter-pole Asymmetric Rotor Design for Torque Ripple Reduction in PMaSynRMs under Different Ferrite Usage levels	Haiwen Sun, Yuli Bao, Jing Li, Shuo Wang, He Zhang, Yannian Hui, Wenting Chu, Hengyu Li University of Nottingham Ningbo, China
WEMDCD25-000095	Analytical-FE Study of Rotor-Dependent Hairpin Conductor Sizing in High-Performance IPMSMs	Riccardo Notari, Stefano Nuzzo, Davide Barater, Michele Degano, Christopher Gerada, Giampaolo Devito University of Nottingham, UK

WEMDCD25-000105	Analytical Design Optimization of Permanent Magnet Assisted Synchronous Reluctance Machines Considering Different Driving Cycle Clustering	Gianvito Gallicchio, Mauro Di Nardo, Francesco Cupertino Politecnico di Bari, Italy
WEMDCD25-000107	Experimental Assessment of a Synchronous Reluctance Machine featuring an Additive Manufactured Rotor	Mauro Di Nardo, Gianvito Gallicchio, Oguz Korman, Jacopo Riccio, Amedeo Vannini, Michele Degano, Chris Gerada, Richard Hague, Leonidas Gargalis Politecnico di Bari, Italy
WEMDCD25-000116	The Study of Hybrid Permanent Magnets in Synchronous Generators for Hydroelectric Application	Emir Poskovic, Alex Borlera, Luca Ferraris, Silvio Vaschetto, Alberto Tenconi Politecnico di Torino, Italy
WEMDCD25-000125	Analytical Computation of Permanent Magnet Eddy Current Loss in Surface Mounted Machines Considering Circumferential Segmentations	Hamid Ali Khan, Alberto Tessarolo University of Trieste, Italy

12:20-13:30	Electrical Drives and their Control 04	
WEMDCD25-000048	Insights into Computational Burden and Performance of Current Control Algorithms for High Switching Frequency GaN-Based Inverters	Francesco Lelli, Federico Marcolini, Giulio De Donato, Fabio Giulii Capponi, Marco Cannone, Maurizio Incurvati University of Rome La Sapienza, Italy
WEMDCD25-000025	Low Complexity Model Predictive Control for Asymmetrical Six-Phase Motors	João Serra, Fernando Bento, Antonio Cardoso CISE—Electromechatronic Systems Research Centre, University of Beira Interior, Portugal
WEMDCD25-000096	Open-End Winding Triple Rectifier for Wind Turbine with Integrated Energy Storage	Salvatore Foti, Gioele Baia, Salvatore De Caro, Luigi Danilo Tornello, Antonio Testa, Danilo Campagna University of Messina, italy
WEMDCD25-000097	Extended-Speed-Range Low-Torque-Ripple Control for Unsaturated Switched Reluctance Motors	Ali Akbar Emarloo, Luca Papini, Paolo Bolognesi University of Pisa, Italy
WEMDCD25-000113	A Novel Five-Leg Three-Level T-Type Inverter for High-Efficiency Dual-Motor Electric Vehicles	Danilo Campagna, Salvatore Foti, Antonio Testa, Cedric Caruana, Cyril Spiteri Staines, Maurice Apap IUSS Pavia, Italy
WEMDCD25-000121	Improved Field Oriented Control for Switched Reluctance Machines With Large Step Response Capability	Emilio Carfagna, Giovanni Migliazza, Emilio Lorenzani University of Modena and Reggio Emilia, Italy

WEMDCD25-000037	Design of Speed Regulator for Four Quadrant Operation with Derating and Delay	Francisco Ulloa-Herrera, Kuntal Mandal, Javier Corea-Araujo, Jordi Canals-Mascorda, Xavier Genaro-Muñoz, Agustin Bucciarelli IDIADA Automotive Technology, Spain

12:20-13:30	Sustainable Machines and Drives for Industrial and Transport Applications 04	
WEMDCD25-000086	Comparison of Rare-Earth free Synchronous Motors for Traction Applications	Andrea Credo, Giuseppe Fabri, Federico Centi, Francesco Parasiliti Collazzo, Marco Villani University of L'Aquila, Italy
WEMDCD25-000089	Particular surface mounted PM Motor Control Technique based on Active Harmonic Elimination	Antonios Sideris, Georgios Sakkas, Antonios Kladas National Technical University of Athens, Greece
WEMDCD25-000054	Fuzzy logic-based energy management strategy for a hybrid specialized tractor	Nicolo' Federico Quattromini, Simone Ferrante, Stefano Nuzzo, Nicola Lenzini, Davide Barater, Stefano Fiorati University of Modena and Reggio Emilia, Italy
WEMDCD25-000106	Sustainable Design Optimization of Permanent Magnet Assisted Synchronous Reluctance Machines	Mauro Di Nardo, Gianvito Gallicchio, Francesco Cupertino Politecnico di Bari, Italy
WEMDCD25-000122	A Comprehensive Benchmark of Different Motor Topologies for High-Performance 2-wheelers Application	Vedanadam Mudumbai Acharya, Dheeraj Bobba, Shafigh Nategh, Pascal Boulanger SEDRIVE AB, Sweden
WEMDCD25-000124	Vibroacoustic Analysis of an Electric Motor with Reduced Rare Earth Content	Davide Oldoini, Giampaolo Devito, Saverio Giulio Barbieri, Matteo Giacopini, Stefano Nuzzo University of Modena and Reggio Emilia, Italy

Industrial Panel Sessions

IES EMTC Industrial Panel – Session 1 - Wednesday, April 9th

Challenges in Cooling and Insulation Design of Electric Machines for Heavy Vehicles

Chair: Michael Galea (EMTC Secretary)

Panelists:

Alessandro Cadel (De Angeli Prodotti)
Olga Shtyka (Dupont)
MD Jahirul Islam (SEDRIVE AB)

Abstract: This Industrial Panel is organised and hosted by the IEEE IES Electrical Machines Technical Committee and will be chaired by the IES EMTC Secretary Michael Galea. The discussion will address the most pressing challenges with the cooling and insulation design of electrical machines for heavy vehicles. This includes, but not exclusive to i) current cooling topologies, technologies and their applicability, ii) the design and optimization tools for cooling available today and their limitations, iii) reliability and lifetime considerations of machines, iv) insulation design and degradation.

IES EMTC Industrial Panel – Session 2 -Thursday, April 10th

Challenges in Design and Optimization of Electric Machines

Chair: Shafigh Nategh (Huawei & EMTC Chair)

Panelists:

Takashi Yamada (JMAG International)
Martino Bailoni (Dupont)
Christophe Viguier (Safran Tech)
Philippe Farah (Yeesma)

Abstract: This Industrial Panel is organised and hosted by the IEEE IES Electrical Machines Technical Committee and will be chaired by the IES EMTC Chair Shafigh Nategh. The discussion will address the most pressing challenges with the design and optimisation of electrical machines for passenger cars. This includes, but not exclusive to i) current machine topologies, technologies and their applicability, ii) the design and optimization tools available today and their limitations, iii) reliability and lifetime considerations of machines.

Awards

The WEMDCD Alessandro Costabeber Best Student Paper Award

The WEMDCD Alessandro Costabeber Best Student Paper Award was established in the WEMDCD 2021 edition in memory of Dr Alessandro Costabeber for the valued, supportive, and fair supervision he has always provided at both undergraduate and postgraduate levels. Dr Costabeber was a tremendously valued colleague, and his work ethic was very strong, regardless of whether he was doing research or teaching. He was supremely talented at both, with a strong portfolio of imaginative research and a collection of teaching prizes.

The WEMDCD Alessandro Costabeber Best Student Paper Award will be assigned to up to three technical papers for outstanding technical contribution and competence displayed in a poster presented at WEMDCD. Orally presented papers and keynote papers are not eligible.

The first prize will be €500, which will be granted by the Industrial Electronics/Industry Application/Power Electronics North Italy Section Joint Chapter. The second and third prizes will be €300 and €200 respectively, granted by the MDPI Machines journal.

Student paper submissions require the first author to be a student or an early career researcher who has been awarded the PhD not earlier than July 2023. Only the papers presented by the first author are eligible. The awards will be granted during the WEMDCD closing ceremony.

Women in Transport Best Student Paper Award

One of the WEMDCD 2025 main goals is to promote a better gender balance in the automotive industry and academia. In a field characterised by significant gender disparities, addressing this challenge is of paramount importance. The creation of fair and inclusive work and educational environments is fundamental to promoting greater representation of women and ensuring that the talents and abilities of all individuals, regardless of gender, are properly recognised and utilised.

To this end, the WEMDCD 2025 edition proposes that the Women in Transport Best Student Paper Award be assigned to one technical paper for outstanding technical contribution and competence displayed in a paper presented at WEMDCD. Participation in selection requires the author to be a female student or female early career researcher who has been awarded the PhD no earlier than July 2023.

The awarded student or early career researcher will be invited as a Speaker at the 2025 edition of Summer School – Women in Transport of MUNER – The Motorvehicle University of Emilia Romagna, which will be held in Bologna in July 2025. The Summer School is endorsed by the MUNER Gender and Diversity Empowerment Committee and by the Women in Transport EU platform. Travel & accommodation expenses up to €500 Euro will be covered, thanks to a personal contribution provided by Dr Rupert Cruise supported by the UK Magnetics Society (UK MagSoc).

The award will be granted during the WEMDCD closing ceremony.

Sustainability

As conference organisers, we have a key social and environmental responsibility. Sustainability has become a paramount concern, and the rising trend of incorporating sustainable measures into event planning is the answer to this concern, as well as a commitment to reduce the ecological impact while maximising the benefits. With this in mind, the WEMDCD 2025 organising committee is working on a green-oriented event, trying to adopt all possible best practices to respect and contribute positively to the environment, society, and economy.

The main goals will include economic sustainability, prioritising local vendors to support the local economy and community; environmental sustainability, reducing the event's ecological footprint as much as possible; and social sustainability, ensuring a safe and inclusive environment for all attendees.

The hosting institution, the University of Malta, boasts a strong commitment to ecological and social sustainability. For several years now, the university has been pursuing a path of integrating sustainability into its activities: teaching, research, third mission, and public engagement. The path undertaken aims to develop the principles of sustainability through a shared and systematic strategy, acknowledging the Sustainable Development Goals and the 2030 Agenda, which have been set forth by the United Nations and formally adopted in 2015.

The conference organisation will follow a paperless philosophy, prioritising digital solutions such as digital event platforms and web event applications to limit the use of paper both before and during the event. The use of printed items, such as flyers, brochures, invitations, etc., in promotional activities will be minimised. Great attention will be paid to food waste. Materials for signage, decorations, and exhibition will mostly be reusable. Recycling throughout the event will be ensured by providing clearly marked recycling bins all over the conference venue. Local non-profit organisations involved in social inclusion activities will be invited to promote their work and spread their message during the event.

Last but not least, one of the technical calls for papers of this conference focuses on sustainability, i.e. a special session entitled “Sustainable Machines and Drives for Industrial and Transport Applications” is included in the final programme. With a rising global awareness of environmental concerns, sustainability in events is no longer just a trend but an imperative shift. WEMDCD 2025 will join this important challenge with a strong commitment to an environmentally friendly approach to minimise the event's impact on our planet.

General Information

Badge Policy and Venue Access

All participants are kindly requested to wear their name badge at all times. Access to the conference venue will be restricted to officially registered attendees.

Speaker Guidelines

To ensure smooth session transitions, speakers should arrive at the venue at least 10 to 15 minutes prior to their scheduled presentation. Given the structured nature of the programme, it is essential to adhere to the allocated timeslot to maintain the session's flow. Speakers using USB drives should upload their files in advance at the slide centre to avoid delays. For logistical efficiency, the use of personal laptops is discouraged. Should further assistance be required, session chairs or conference staff will be available to provide support.

Poster Presentation Guidelines

Poster boards will be available from 08:00 on both days of WEMDCD. Poster size is A0. Presenters need to have their poster ready, displayed in its proper place, at least by the end of the morning coffee break (both days). The official poster sessions will be during the lunch break, however presenters are encouraged to let their poster be displayed for the whole duration of the day.

Language English will be the language of the conference.

Important Contacts

conferences@um.edu.mt & wemdcd2025@um.edu.mt

For any other queries, please contact Mr Antonis Theofanous.

antonis.theofanous@um.edu.mt
