ICHQP 2022 20th International Conference on Harmonics and Quality of Power Naples, Italy, May 29th - June 1st 2022







Program

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Welcome

Chairs' Message

Dear Colleagues, Dear Friends,

It is a privilege and an honor to welcome you to the 20th edition of the International Conference on Harmonics and Quality of Power which is taking place in the beautiful southern Italian city of Naples, from Sunday 29th May until Wednesday 1st June, 2022.

ICHQP is one of the premier international conferences in the field of electrical power engineering and is the only IEEE PES conference dedicated to the area of power quality. The conference presents academic and industrial work of technical excellence at the forefront of power quality research and practical developments. The 20th ICHQP will continue this tradition, providing an excellent opportunity for individuals from academia and industry working in the area of power quality to come together to share ideas.

The conference is co-sponsored by the IEEE Power and Energy Society, the IEEE Italy Section PE Chapter and the EnSiEL, the Italian National Inter-Universities Consortium – Energy and Electrical Power Systems. It is hosted by the three Universities of Naples: University of Naples "Federico II", University of Campania "Luigi Vanvitelli", and University of Naples "Parthenope".

The last few years have been challenging for everyone and, although we have made progress from the time of the last ICHQP, due to global uncertainties we have decided to hold ICHQP 2022 as a hybrid event. This solution allows us to see each other in person without losing the valuable contributions from those colleagues who have difficulty in traveling, a decision made in the spirit of friendship that distinguishes our community. This opportunity was also made possible thanks to the financial support of the sponsors.

We have worked hard, together with the Organizing and International Technical Committees that we sincerely thank, on creating a stimulating technical program, consisting of keynote and plenary, tutorial, panel, special and regular sessions.

We sincerely hope you enjoy the conference and that the experience leaves you with many happy memories,

Roberto Langella General Chair University of Campania Luigi Vanvitelli Pierluigi Caramia Vice Chair University of Naples Parthenope

Mario Pagano Vice Chair University of Naples Federico II

Program Chairs' Message

It is a great pleasure to present the program of ICHQP 2022. The 20th edition of the International Conference on Harmonics and Quality of Power features the theme of "Power Quality in the Energy Transition", a critical topic because of the growing impact of environmental issues on the operation of power systems across the globe. We are delighted to announce the launch of a new initiative at this year's conference, in which the authors of a selection of papers will be invited to submit extended versions of their research for consideration in a Special Section of the IEEE Open Access Journal of Power and Energy (OAJPE), at a discounted rate.

It is also a great pleasure to welcome you all to the vibrant city of Napoli, in what we are sure will be an exciting and stimulating environment to discuss the challenges related to Power Quality in the Energy Transition. Virtual participation has been also arranged for those who are unable to reach us in person, ensuring that no-one will miss out on this important event.

The theme has been developed across 16 technical sessions and six special sessions, hosting a total of 131 papers. We are also delighted to have two excellent presenters lined up to deliver keynote speeches, closely followed by two panel sessions that we are sure will help set the tone for stimulating discussions. In addition to this, the program includes two tutorials dealing with interharmonics and recent findings on EMC issues related to the harmonic behavior of modern power electronic devices.

Such a rich program is the result of a lot of hard work and is only made possible thanks to the incredible effort of many people to whom we would like to express our sincere gratitude. A great deal of thanks goes to all the reviewers who have delivered quality reviews within demanding timescales. Special thanks are extended to our friends and colleagues who will provide their valuable expertise and energy during the conference in leading tutorial, plenary and special sessions, and chairing the technical sessions. We also thank the sponsors for their support and promotion, and the organizing team whose enthusiastic work ensured the realization of this event.

Finally, we would of course like to thank all of the authors who submitted their papers to ICHQP 2022 and to all the attendees coming from around the world, both in person and online. We hope that you have an enjoyable conference and we look forward to sharing the experience with you.

Adam J. Collin and Daniela Proto

Committees

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Honorary Chair Alfredo Testa (*Università degli Studi della Campania Luigi Vanvitelli*)

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Sunday May 29

1400-1800	Registration
	Room A
1430-1600	Tutorial 1
	Interharmonics: What are the Causes, How to Measure Them and Why Do We Care?
1600-1630	Coffee break
1630-1800	Tutorial 2
	Recent findings on EMC issues related to the harmonic behavior of modern power electronic devices
1830-2000	Welcome Reception

Monday M	lay 30		
0800-1650		Registration	
		Room Aula Magna	
0830-1000		Opening Session	
		Keynote Speeches	
1000-1030		Coffee break	
1030-1200		Panel Session 1	
	The Points of View of T.	SOs and DSOs on the Effects of Ene	rgy Transition on Power Quality:
		Trends, Challenges and Costs	
1205-1230		Meeting with Industries	
1230-1345		Lunch	
1345-1515		Panel Session 2	
	From planning to ope	ration: Evaluating the emission of dis	turbing customer installations
	Room Aula Magna	Room A	Room B
1520-1650	Special Session 1	Technical Session 1	Technical Session 2
	Lightning and Lightning	Distributed Energy Resources	Data Analytics, Monitoring
	Effects on Power Lines		and Measurements
1650-2000		Tour Visit	

0830-1730		Registr	ation	
	Room Aula Magna	Room A	Room B	Room V
0830-1000	Technical Session 3	Technical Session 4	Technical Session 5	1
	Disturbance identification	Distortion from 2 to 150 kHz	Renewable Energy Sources 1	1
	and mitigation techniques			
1000-1030		Coffee	Break	
1030-1200	Special Session 2	Special Session 3	Technical Session 6	1
	Standardization of Measure-	Forecasting and Analytics for	Electric Vehicles and Storage	I
	ments for Low-voltage DC	Power Quality Problems		
	Electricity Grids			
1205-1230	Meeting with Industries	1	I	I
1230-1400		Lun	ch	
1400-1530	Special Session 4	Technical Session 7	Technical Session 8	I
	The IT4PQ project: Towards nor-	Transmission System and	Voltage Dips and Interrup-	I
	mative measurement procedures and tests for characterising In-	High Voltage Applications	tions	
	strument Transformers for Power			
	Quality measurements			
1530-1600		Coffee	Break	
1600-1730	Special Session 5	Technical Session 9	Technical Session 10	Technical Session 11
	Power Quality Data Analytics: A	Smart Grids and Microgrids	Harmonic Estimation Tech-	Virtual Session 1 (Western
	New World of Applications		niques	Time Zone)
2000-2300		Conference	e Dinner	
Wednesday	June 1			
0900-1330		Registr	ation	
	Room Aula Magna	Room A	Room B	Room V
0900-1030	Special Session 6	Technical Session 12	I	Technical Session 13
	Power Quality Issues in Rail-	Renewable Energy Sources 2	I	Virtual Session 2 (Eastern
	way Traction System 6			Time Zone)
1030-1100		Coffee	Break	
1105-1130	Meeting with Industries	1	I	I
1130-1300	Technical Session 14	Technical Session 15	Technical Session 16	I
	Distortions from Customers'	Light Flicker and Voltage	Power Quality Analysis	I
	and Suppliers' Side	Fluctuations		
		Roon	ПА	
1300-1330		Closing Co	eremony	

Tuesday May 31

Program

Tutorial Sessions

Tutorial 1: Interharmonics: What are the Causes, How to Measure Them and Why Do We Care?

Speaker 1: **Jiri Drapela** (*Brno University of Technology, Czech Republic*) Speaker 2: **Leos Kukacka** (*Technical University of Liberec, Czech Republic*) Speaker 3: **Roberto Langella** (*Università degli Studi della Campania Luigi Vanvitelli, Italy*)

Interharmonics are spectral components at frequencies that are not integer multiples of the system fundamental frequency. They do occur in power ac system physiologically due to desynchronization of processes with power system frequency, or even intentionally by means of mains signaling. Besides the typical problems caused by harmonics such as overheating and faster aging, interharmonics create some other problems like excitation of dormant resonances, sub- synchronous oscillations, power transformer saturation, induction motors loss of useful lifetime, light flicker, and interference with PLL based control systems even for very low- amplitude levels (0.1-0.5 %).

Emission of interharmonics can be observed in increasing number of loads. These loads include static frequency converters, cycloconverters, adjustable speed drives for induction or synchronous motors, arc furnaces, induction furnaces, and all loads not pulsating synchronously with the fundamental power system frequency. Moreover, inverter-based generation resources such as photo-voltaic and wind power plants as well as HVDC links are also a source of interharmonics and their penetration in power systems is rapidly increasing.

Besides interharmonics have been deeply studied during the last forty years, proper measuring metrics and fair limits to be adopted are still under discussion.

The tutorial is divided in three parts:

- 1. What Are Interharmonics and Why Do They Occur?
- 2. What Is the Effect of Interharmonics in Power Grids?
- 3. Measurement of Interharmonics, Compatibility Limits.

Tutorial 2: Recent findings on EMC issues related to the harmonic behaviour of modern power electronic devices

Speaker 1: Jan Meyer (*Technische Universitaet Dresden, Germany*) Speaker 2: Sasa Djokic (*The University of Edinburgh, Scotland, UK*)

High efficiency, controllability and flexibility in operating electric appliances and networks are considered as key enablers for the future electricity distribution. As a consequence, the numbers of modern power electronic (PE) devices based on self-commutating circuit topologies with switching frequencies well above 2 kHz have already vastly increased and will continue to increase even more in the future. Inverters for photovoltaic applications, converters for battery storage systems or active power factor corrected rectifiers for electric vehicle chargers are only a few examples. In many cases, due to existing requirements and regulations, the design of these devices is optimized for their performance at power frequency only. This is a non-holistic approach, which often results in less robust modern PE devices and in a range of adverse interactions with the network at frequencies other than the power frequency. Due to the utilized switching frequencies, the impact of those devices especially in the frequency range below 2 kHz is often underestimated or even unknown.

This tutorial aims to provide an overview of some recent findings and state-of-the-art on EMC issues in the frequency range below and, for some aspects, also above 2 kHz related to modern PE devices in distribution networks. After a brief introduction, including an update on some relevant standardization activities, different issues will be presented from both equipment and system perspectives, emphasizing the mutual importance and close relationship between emission and impedance. The key findings will be illustrated using laboratory tests and field measurements.

Plenary Session

Keynote 1: Power Quality and Harmonics–Some Research Topics for the Next 20 Years

Speaker: Alex McEachern (McEachern Laboratories Inc., USA)

This talk will present 8 different research topics that might, during the next 20 years, produce useful results.

- 1. Supraharmonics: measurement, grid characterization, effects, immunity, regulation;
- 2. Microgrid power quality, stability, harmonics, supraharmonics;
- 3. Grid source impedance: subsynchronous, fundamental, harmonic, and supraharmonic;
- 4. Active measurement methods for electric power grids;
- 5. Load immunity techniques: energy storage, and power quality "judo";
- 6. Electric vehicles technology for immunity techniques, and charger challenges;
- 7. Junction between power quality and big data / machine learning / high speed communication paths / new visualization;
- 8. Grid cybersecurity a useful and practical application of our measurement methods.

Keynote 2: The need for a holistic view: Future perspectives of Power Quality research

Speaker: Jan Meyer, (Technical University of Dresden, Germany)

The continuous increase of power electronics is one of the main drivers for the ongoing transformation of modern electricity grids. To the same extend, disturbance interactions are becoming more complex across all voltage levels and often a broader view from different perspectives is required to understand and tackle a particular Power Quality phenomenon comprehensively. This talk illustrates the need for such more holistic views using some examples linked to the present challenges in EMC coordination and closes with some thoughts on the role of universities in future Power Quality research.

Panel Sessions

Panel Session 1: The Points of View of TSOs and DSOs on the Effects of Energy Transition on Power Quality: Trends, Challenges and Costs

Chair: **Alfredo Testa** (*Università degli Studi della Campania Luigi Vanvitelli*) Co-Chair: **Luca Lo Schiavo** (*Italian Regulatory Authority for Energy, Networks and Environment*)

Electrical Power Systems are undergoing massive changes worldwide to transition to about 40% of sustainable renewable energy by 2030 in Europe and USA, a policy which includes closing conventional fossil fuel power plants. Both planning and operation are changing in response to the increasing integration of Power Electronic Interfaced Generation (PEIG) and Power Electronic Interfaced Devices (PEID) at all voltage levels. Moreover, the use of power cables at all voltage levels, increasing amount of fluctuating, sometimes unbalanced, production and an overall reduction of system strength are expected. All of these changes will affect Power Quality. Reducing the consequences of degraded Power Quality, which is known to have severe financial implications, could be one of the most challenging problems to be managed by system operators. Vertical coordination between TSOs and DSOs and horizontal coordination between TSOs are of utmost importance when facing the new challenges for system operators, due to the need of a holistic vision, and this is particularly true for Power Quality. The panel will give the opportunity of hearing and discussing TSOs and DSOs points of view on the trends, challenges and costs of Power Quality in the presence of the undergoing energy transition.

Panelists:

Enrico Maria Carlini (*Terna*, *IT*) Andrea Caregari (*E-Distribuzione*, *IT*) Xavier Xianjun Yang (*EDF*, *FR*) Julien Vanvilthoven (*ELIA*, *BE*) Jacco Smit (*Tennet*, *NL*) Gaurav Singh (*EPRI*, *US*)

Panel Session 2: From planning to operation: Evaluating the emission of disturbing customer installations

Chair: Jan Meyer (Technische Universitaet Dresden, Germany)

The share of power electronics in customer installations (consumption and generation) increases at all network levels and the evaluation of its emission is of essential importance to ensure Electromagnetic Compatibility (EMC) nowadays as well as in the future. This includes likewise a fair and justifiable determination of emission limits in the planning stage as well as reliable methods to determine the contribution of a customer installation to the total disturbance level in the network, when it is in operation. Both issues are emerging challenges in the field of Power Quality both for distribution and transmission grids and consequently two joint CIGRE/CIRED working groups were initiated on these topics. JWG C4.40 deals with the revision of the IEC technical reports 61000-3-6,-7,-13 and -14 covering the determination of emission limits during the planning stage for customer installations connected to LV, MV, HV and EHV grids. JWG C4.42 addresses the continuous assessment of the customer contribution with particular focus on harmonics.

Panelists:

Mark Halpin (Auburn University, US) Igor Papič (University of Ljubljana, SE) Sasa Djokic (The University of Edinburgh, UK) Jan Meyer (Technische Universitaet Dresden, DE) Thomas Naef (Camille Bauer Metrawatt AG, CH)

Special Sessions

Special Session 1: Lightning and Lightning-induced Effects on Power Lines

Chair: Amedeo Andreotti (Università degli Studi di Napoli Federico II) Fabio Napolitano (Università di Bologna)

Monday 30 May, Room: Aula Magna

1520 - 1535 Quantifying the Probability of Partial Discharge in VFD Fed Electric Motors Under Voltage Harmonics Concentration

Hassan, Waqar; Hussain, Ghulam Amjad; Mahmood, Farhan; Akmal, Muhammad

1535 - 1550 Lightning-Induced Overvoltage Peaks Considering Soil Parameters Frequency-Dependence: New Approach with Dominant Frequency Associated with Lightning Current Front Time

Moura, Rodolfo; Mestriner, Daniele; Procopio, Renato; Schroeder, Marco Aurelio; Assis, Fernando; Delfino, Federico

1550 - 1605 **Comparison between two calculation tools for the appraisal of lightning induced voltages**

Napolitano, Fabio; Tossani, Fabio; Andreotti, Amedeo; Borghetti, Alberto

- 1605 1620 **The Sommerfeld-Goubau Theory for the Transient Response of Towers** Stracqualursi, Erika; Araneo, Rodolfo; Brandao Faria, Jose Antonio Marinho; Burghignoli, Paolo; Andreotti, Amedeo
- 1620 1635 **Propagation and Attenuation of Surge Voltages and its consequence for the insulation coordination in Low-Voltage AC Circuits** *Heremans, Florian, Vliegen, Kristof Van Reusel, Koen J;*
- 1635 1650 Modeling High-voltage Transmission Line Operation under Double Earth Faults for Calculating Voltage Induced on Pipeline Bulatov, Yuri; Kryukov, Andrey; Suslov, Konstantin

Special Session 2: Standardization of Measurements for Low-Voltage DC Electricity Grids

Chair: Helko van den Brom (VSL Dutch Metrology Insitute) Daniele Gallo (Università degli Studi della Campania Luigi Vanvitelli)

- Tuesday 31 May, Room: Aula Magna
- 1030 1045 Measurement Setup for a DC Power Reference for Electricity Meter Calibration
 - Frigo, Guglielmo; Braun, Jonathan
- 1045 1100 Noise in DC Systems and the Potential Influence on Arc Detection Wang, Da; Tichelen, Paul
- 1100 1115 Testing of DC Electricity Meters with Broadband Conducted Electromagnetic Disturbances

Van den Brom, Helko E.; Marais, Zander; van Leeuwen, Ronald

- 1115 1130 **Detection of Dips, Swells and Interruptions in DC Power Network** *Cipolletta, Giuliano; Delle Femine, Antonio; Gallo, Daniele; Seferi, Yljon; Fan, Fulin; Stewart, Brian*
- 1130 1145 **On-site PQ measurements in a real DC micro-grid** *Melero, Julio; Bruna, Jorge; Leiva, Javier*
- 1145 1200 **IEEE Power Quality Standards** Sabin, Daniel; Norwalk, Matthew; Kittredge, Kevin; Johnston, Steven

Special Session 3: Forecasting and Analytics for Power Quality Problems

- Chair: Antonio Bracale (Università degli Studi di Napoli Parthenope) Pasquale De Falco (Università degli Studi di Napoli Parthenope)
- Tuesday 31 May, Room: A
- 1030 1045 Predicting Resonance Frequencies in Distribution Networks with Grid-Connected Inverters

Moradi, Arash; Zare, Firuz; Yaghoobi, Jalil

1045 - 1100 On the Forecast of the Voltage Sags Using the Measurements in Real Power Systems

Casolino, Giovanni Mercurio; Di Stasio, Leonardo; Varilone, Pietro; Verde, Paola; Noce, Christian; De Santis, Michele

1100 - 1115 Transmission Grid Power Quality: Unbalance Factor Forecast by a Novel Three-Phase Power Flow

Benato, Roberto; Gardan, Giovanni; Rusalen, Luca

1115 - 1130 Application of Machine Learning Methods for Recognition of Daily Patterns in Power Quality Time Series

Strunz, Elias; Zyabkina, Olga; Meyer, Jan

1130 - 1145 Trend Analysis for Power Quality Parameters based on Long-term Measurement Campaigns

Domagk, Max; Meyer, Jan; Huang, Wei; Wang, Tongxun; Feng, Dandan; Mayer, Heiko; Wenig, Simon; Lindner, Marco

1145 - 1200 Probabilistic Power Quality Level Forecasting through quantile regression models

Bracale, Antonio; Caramia, Pierluigi; De Falco, Pasquale; Carpinelli, Guido

Special Session 4: The IT4PQ project: Towards normative measurement procedures and tests for characterising Instrument Transformers for Power Quality measurements Chair: Gabriella Crotti (Istituto Nazionale di Ricerca Metrologica) Jan Meyer (Technische Universität Dresden) Tuesday 31 May, Room: Aula Magna 1400 - 1415 Impact of external influences on the frequency dependent transfer ratio of resin cast MV voltage instrument transformers Stiegler, Robert; Meyer, Jan 1415 - 1430 Reference system for current sensor calibrations at power frequency and for wideband frequencies Chen, Yeying; Dubowik, Alexander; Mohns, Enrico

- 1430 1445 Stray Parameter Evaluation of Voltage Transformers for PQ Measurement in MV Applications
 - Giordano, Domenico; Crotti, Gabriella; Letizia, Palma Sara; Palladini, Daniele
- 1445 1500 Adaptive Channel Equalization for Frequency Response Correction of Instrument Transformers Resende, Denise Fonseca; Duque, Carlos; Nepomuceno, Erivelton; Lima,

Marcelo; Silva, Leandro R. M.

1500 - 1515 Combined Effect of Temperature and Humidity on Distorted Currents Measured by Rogowski Coils

Costa, Federica; Mingotti, Alessandro; Peretto, Lorenzo; Tinarelli, Roberto

1515 - 1530 Practical Aspects of Accurate Harmonic Voltage Measurements in Transmission Systems

Meyer, Jan; Stiegler, Robert; Konzelmann, Simon; Kilter, Jako

Special Session 5: Power Quality Data Analytics: a New World of Applications

- Chair: Walmir Freitas (Universidade Estadual de Campinas) Ricardo Torguato (Universidade Estadual de Campinas)
- Tuesday 31 May, Room: Aula Magna
- 1600 1615 **Synchronized Waveforms a Frontier of Data-Based Power System and Apparatus Monitoring, Protection and Control** *Xu, Wilsun; Huang, Zhenyu; Xie, Xiaorong; Li, Chun*
- 1615 1630 Practical Methods for Online Monitoring of Harmonic Resonances in DFIG-Based Wind Parks

Torquato, Ricardo; Arguello, Andres; Freitas, Walmir

1630 - 1645 Evaluation of Metrics to Detect High Impedance Faults Using Real Current Signals

Vieira, Jose M; Lopes, Gabriela N; Menezes, Thiago

- 1645 1700 Utilization of an Expert System Enhanced with Machine Learning for Automatic Voltage Sag Identification and Analysis Sabin, Daniel; Peltier, Colton
- 1700 1715 Classification of Scalogram Signatures for Power Quality Disturbances Using Transfer Learning

Salles, Rafael S.; Almeida, Gabriel; Ribeiro, Paulo

1715-1730 Identification, Location, and Remediation of Incipient Fault and Failure Conditions Using Waveform Monitoring and Automated Analysis Wischkaemper, Jeff; Russell, B. Don; Benner, Carl L.; Manivannan, Karthick

Special Session 6: Power Quality Issues in Railway Traction System

Chair: **Philippe Ladoux** (*Universite de Toulouse*)

Mauro Carpita (Haute école d'Ingénierie et de Gestion du Canton de Vaud)

- Wednesday 1 June, Room: Aula Magna
- 0900 0915 Waveform Distortion Emission Assessment on Pantograph Measurements from Low-Frequency Railway Electrification

Salles, Rafael S.; Ronnberg, Sarah; Mariscotti, Andrea

0915 - 0930 Calculation of the Voltage Unbalance Factor for 25kV-50Hz Railway Substations

Flumian, Didier DF; Ladoux, Philippe; Sarraute, Emmanuel

- 0930 0945 Interharmonic Analysis for Static Frequency Converter Station Supplying a Swedish Catenary System Salles, Rafael S.; Ronnberg, Sarah
- 0945 1000 Catenary overvoltage stabilization of DC railway electrical system by integrating EV charging stations

Guo, Baoling; Pouget, Julien ; Bossoney, Luc; Carpita, Mauro; Meier, Thomas; Maye, Jean-Paul

1000 - 1015 Voltage Quality of an AC Grid Supplying a Railway Power System with Energy Saving Strategy

> Andreotti, Amedeo; Di Pasquale, Antonio; Mottola, Fabio; Proto, Daniela; Pagano, Mario

1015 - 1030 Modern Power Quality Improvement Devices Applied to Electric Railway Systems

Brenna, Morris; Jafari Kaleybar, Hamed; Foiadelli, Federica; Zaninelli, Dario

Technical Sessions

Technical Session 1: Distributed Energy Resources

Chair: Yahia Baghzouz (University of Nevada)

Monday 30 May, Room: A

1520 - 1535 **Operation of a Distributed Generation Plant in a Power Supply System** with Non-linear and Asymmetric Load

Bulatov, Yuri; Kryukov, Andrey V.; Suslov, Konstantin

- 1535 1550 **Customer Bill Management Using Thermal and Virtual Electricity Storage** Shaon, M.A.R.; Baghzouz, Yahia
- 1550 1605 Analysis of power quality concerning COVID-19-related anomalies and integration of distributed energy resources
 - Antic, Tomislav; Capuder, Tomislav
- 1605 1620 **Deep Learning Method With Manual Post-Processing for Identification of Spectral Patterns of Waveform Distortion in PV Installations** *Oliveira, Roger; Ravindran, Vineetha; Ronnberg, Sarah; Bollen, Math*
- 1620 1635 **The use of harmonic phasors and complex impedances in renewable power plant assessment** *Johan Beukes; Jacques Wattel*
- 1635 1650 Improving PV Hosting Capacity by Implementing Energy Storage Systems on Distribution Networks

Jairo Giacomini Jr; Juan Carlos Cebrian; Heimo Parec	Jairo	Giacomini	Jr; Juan	Carlos	Cebrian;	Helmo	Parede
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Technical Session 2: Data Analytics, Monitoring and Measurements

Chair: Wilsun Xu (University of Alberta)

Monday 30 May, Room: B

- 1520 1535 **Power Quality Meters Based on Digital Inputs: A Feasibility Study** *Frigo, Guglielmo; Castello, Paolo; Agustoni, Marco; Sulis, Sara*
- 1535 1550 **Low frequency currents source identification** Schachinger, Philipp; Albert, Dennis; Renner, Herwig
- 1550 1605 **Load Disaggregation Through Particle Filtering of Harmonic Features** Poyatos, Aaron; Isanbaev, Viktor; Blanco, Jose Luis; Viciana, Eduardo; Ventura, Jorge; Arrabal-Campos, Francisco; Banos, Raul; Alcayde, Alfredo A.; Montoya, Francisco
- 1605 1620 **Novelty Detection based on Dynamic Time Warping similarity metric applied to Power Quality Signals** *Pires, Paulo PVL; Travassos, Fabricio; Kapisch, Eder B; Silva, Leandro R. M.; Duque, Carlos; Ribeiro, Paulo*
- 1620 1635 Analysis of Signal Processing Techniques for High Impedance Fault Detection in Distribution Systems

Lopes, Gabriela N; Lacerda, Vinicius; Vieira, Jose M; Coury, Denis

1635 - 1650 **Probabilistic Harmonic Estimation in Uncertain Transmission Networks** Using Sequential ANNs Zhao, Yuqi; Milanovic, Jovica

Technical Session 3: Disturbance Identification and Mitigation Techniques

Chair: Julio Barros Guadalupe (Universidad de Cantabria)

Tuesday 31 May, Room: Aula Magna

- 0830 0845 **A new harmonic extraction method for estimation of the reference compensation current in shunt active power filters** *Barros, Julio; de Apraiz, Matilde; Diego, Ramon I.*
- 0845 0900 A Voltage Unbalance Mitigation Technique for Low-voltage Applications with Large Single-phase Loads Negri, Simone; Superti-Furga, Gabrio; Tironi, Enrico
- 0900 0915 Detection and Protection Against Geomagnetically Induced Current via Harmonic Signature Analysis
 - Xie, Jiahao; Meliopoulos, Sakis; Cokkinides, George
- 0915 0930 A Study on Estimation of Harmonic Sources and SC Installation Points in Distribution Systems Kawasaki, Shoji; Shiraishi, Ryuji
- 0930 0945 **A New Damping Scheme of LLCL Filter for Grid-Tied PV Inverter Output** Harmonics Mitigation Zhong, Fang; Chang, Gary; Nguyen, Kha T.
- 0945 1000 **Entropy measures applied on Time-Frequency domain for detection and identification of Power Quality disturbances** Darambazar, Gandorj; Moukadem, Ali; Colicchio, Bruno; Patrice, Wira

Technical Session 4: Distortion from 2 to 150 kHz

Chair: **Sarah Ronnberg** (*Lulea Tekniska Universitet*) **Tuesday 31 May**, Room: **A**

- 0830 0845 **Telephone Interference from Solar PV Switching** Singh, Gaurav; Cooke, Thomas; Johns, Jason; Vega, Luis; Valdez, Ariel; Bull, Gloria
- 0845 0900 Active High Pass Filter for the Measurement of Supraharmonics Lambrechts, Johannes J; Beukes, Johan
- 0900 0915 **Supraharmonics within a datacenter-emission and propagation** *Sutaria, Jil; Espin-Delgado, Angela; Ronnberg, Sarah*
- 0915 0930 Measurement and Analysis of the Low Voltage Network Impedance in the Supraharmonic Range

Erhan, Vlad; Slangen, Tim; Cuk, Vladimir; Cobben, Sjef; van Wijk, Thijs

0930 - 0945 Application of Clustering and Dimensionality Reduction Methods for Finding Patterns on Supraharmonics Data

Espin-Delgado, Angela; Sutaria, Jil; Oliveira, Roger; Ronnberg, Sarah

0945 - 1000 Analysis of supraharmonic emission in a microgrid in islanded and interconnected operation

> Romero-L, Miguel; Quintero-Molina, Vanessa M; Garzón, Camilo; Pavas, Andres; Blanco-Castaneda, Ana M.; Kannan, Shrinath; Meyer, Jan

Technical Session 5: Renewable Energy Sources 1

Chair: Angela Russo (Politecnico di Torino)

Tuesday 31 May, Room: B

0830 - 0845	Third Harmonic and its Relation to Solar Elevation Angle in a PV Instal-
	lation with Solar Tracking Systems
	Oliveira, Roger; Ronnberg, Sarah; Bollen, Math

0845 - 0900 Managing Uncertainties in Wind Farm Harmonic Studies Using Unscented Transform

Lennerhag, Oscar; Bollen, Math

- 0900 0915 **Long-Term Harmonic Analysis of Grid-Connected Photovoltaic Systems** *Šćekić, Lazar; Mujović, Saša*
- 0915 0930 Power Symmetrical Components as Grid Usage Indicator for Unbalanced Prosumers

Klusacek, Jan; Drapela, Jiri; Langella, Roberto

0930 - 0945 A Study on Cross-Harmonic Generation by Large Three-phase Inverters in Solar Farm Environments

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0945 - 1000 Influence of System Parameters on Harmonic Distortion Contributions of Renewable Power Plants

Plessis, Francois D.; Beukes, Johan

Technical Session 6: Electric Vehicles and Storage

Chair:	Dario	Zanine	elli (Politecr	nico di M	lilano)	
	Linda	Barelli	i (Università	degli St	udi di l	Perugia)
			_			

- Tuesday 31 May, Room: B
- 1030 1045 **Power Quality Indicators of Electric Vehicles in Distribution Grid** Wang, Xiaoxi; Jafari Kaleybar, Hamed; Brenna, Morris; Zaninelli, Dario
- 1045 1100 Impact of Electrical Vehicle Residential Charging Stations on the Quality of the Low Voltage Network Supply Pisano, Giuditta; Pilo, Fabrizio; Ruggeri, Simona; Soma, Gian Giuseppe; Falabretti, Davide; Grillo, Samuele; Gulotta, Francesco
- 1100 1115 Observed Harmonic Levels on low voltage grid during EV DC Fast Charging

Giri, Manav; Ronnberg, Sarah; Bollen, Math

1115 - 1130 Assessing the Harmonic and Supraharmonic Impact of Electric Vehicle Charging Facilities

Singh, Gaurav; Howe, William

- 1130 1145 **Comparison of harmonic models for a commercial battery energy storage system in charging and discharging mode** *Abdelsamad, Ahmed S.; Myrzik, Johanna M.A.; Kaufhold, Elias; Meyer, Jan; Schegner, Peter*
- 1145 1200 On-Site Harmonic, Load Rejection Overvoltage, and Anti-Islanding Scheme Verification of a 20 MW BESS Interconnection to a Distribution Feeder

Nassif, Alexandre B.; Wheeler, Keaton; Torquato, Ricardo; Freitas, Walmir

Technical Session 7: Transmission System and High Voltage Applications

Chair: Luigi Rubino (Università degli Studi della Campania Luigi Vanvitelli) Tuesday 31 May, Room: A

- 1400 1415 **Towards an Impedance-Based Criterion for Efficient Analysis of Resonant Overvoltages in the Swedish Transmission System** Lennerhag, Oscar; Sundberg, Gustav; Rogersten, Robert; Rastrom, Stefan
- 1415 1430 Challenges in Application of the Traveling Wave-Based Fault Location Methods Applied to HVDC Systems: Evaluation of Classical One- and Two-Terminal Methods

Candido Vieira, Julio Cesar; Fernandes, Damasio; Neves, Washington; Vigolvino Lopes, Felipe

- 1430 1445 **Study on the State Feedback Selection and Measurement for the Application of an LQRI Secondary Voltage Regulator to a Transmission System** *Vicenzutti, Andrea; Marzolla, Fabio; Sulligoi, Giorgio; Giannuzzi, Giorgio Maria; Pisani, Cosimo*
- 1445 1500 Impact of Synchronous Compensators on the Robustness in Short-Circuit Conditions of Transmission Systems with High Share of RES Bracale, Antonio; Caramia, Pierluigi; De Falco, Pasquale; Di Mambro, Enrica; Varilone, Pietro; Verde, Paola
- 1500 1515 **Secant Method Applied to Control of HVDC in the Harmonic Domain** *Ramirez, Yovanny; Ramirez, Abner; Lazaroiu, Cristian*

Technical Session 8: Voltage Dips and Interruptions

Chair: Paola Verde (Università degli Studi di Cassino e del Lazio Meridionale)

Tuesday 31 May, Room: B

1400 - 1415 Impact of Voltage Dips Originated in the Transmission Grid on EV Charging Stations

Oliveira, Roger; Bollen, Math

- 1415 1430 Voltage Sag Source Location Methods' Performance during Transient and Steady-state Periods Mohammadi, Younes; Bollen, Math
- 1430 1445 **Power Quality Data Platform for Analysis and Location of Voltage Dips:** a **Preliminary Study**

Castello, Paolo; Muscas, Carlo; Pegoraro, Paolo Attilio; Sulis, Sara; Rens, Johan; van Zyl, Jacobus

1445 - 1500 Optimal Siting and Sizing of Electrical Energy Storages Accounting for Voltage Dip Economic Regulation

Mottola, Fabio; Proto, Daniela; Varilone, Pietro; Verde, Paola

- 1500 1515 **Impact of urbanization development on power system operation** Balaban, Georgiana; Lazaroiu, Christian; Dumbrava, Virgil; Roscia, Mariacristina
- 1515 1530 The Impacts of Voltage Disturbances Due to Faults In the Power Supply System of A Data Center

Ahmed, Kazi Main Uddin; Bollen, Math; Alvarez, Manuel; Letha, Shimi Sudha

Technical Session 9: Smart Grids and Microgrids

Chair: Daniela Proto (Università degli Studi di Napoli Federico II)

Tuesday 31 May, Room: A

- 1600 1615 **Comparison between ring and radial configurations of the University of Trieste campus MV distribution grid** *Chiandone, Massimiliano; Quaia, Stefano; Sulligoi, Giorgio; Vicenzutti, Andrea*
- 1615 1630 Assessment of FACTS devices nonsinusoidality in Smart Grid Sosnina, Elena; Bedretdinov, Rustam; Ivanov, Anton
- 1630 1645 A Decision Theory Approach for the Multi-objective Optimal Allocation of Active Filters in Smart Grids

Carpinelli, Guido; Mottola, Fabio; Proto, Daniela; Russo, Angela
1700 Harmonic interaction of LED lamps in islanded microgrids

- 1645 1700 Harmonic interaction of LED lamps in islanded microgrids Meinck, Moritz; Blanco-Castaneda, Ana M; Kannan, Shrinath; Meyer, Jan; Pavas, Andres
- 1700 1715 Application of Photovoltaic Generation for Harmonic Distortion Mitigation in a Microgrid

de Barcellos Martins, Daniella; Oleskovicz, Mario; Rodrigues Pereira Jr, Benvindo

1715 - 1730 Harmonic Distortion in Low Voltage Residential Grids Caused by LED Lamps

Hernandez, Jairo; Romero, Andres; Mueller, Sascha; Meyer, Jan

Technical Session 10: Harmonic Estimation Techniques

Chair: Sasa Djokic (The University of Edinburgh)

Tuesday 31 May, Room: B

1600 - 1615 Reexamination of the Active Power Direction Method for Identifying the Sources of Harmonic Distortion

Senderovych, Gennadii; Shcherbakova, Polina; Abramovitz, Alexander

1615 - 1630 Machine Learning Metamodeling of Harmonic Sources in LV Distribution Networks

Dada, Ansaar; Laboure, Eric; Bensetti, Mohamed; Yang, Xavier; George, Benoit; Caujolle, Mathieu

- 1630 1645 Accurate and Fast Technicalized Assessment of Waveform Distortions in Presence of Low- and High-frequency Spectral Components Carpinelli, Guido; Bracale, Antonio; Varilone, Pietro; Sikorski, Tomasz; Rezmer, Jacek; Kostyla, Pawel
- 1645 1700 Analysis of Harmonic Propagation in Power Systems Using Standing Waves

Bukh, Bjarne S; Leth Bak, Claus; Faria da Silva, Filipe

- 1700 1715 Independent Component Analysis for Distortion Estimation at Different Points of a Network with Multiple Harmonic Sources de Oliveira, Mateus M; Lima, Marcelo A. A.; Silva, Leandro R. M.; A. Duque, Carlos; Ribeiro, Paulo
- 1715 1730 Use of Actual and Reference Impedances in Two Harmonic Emission Assessment Methods

Spelko, Aljaz; Papic, Igor; Iqbal, Zafar; Djokic, Sasa

Technical Session 11: Virtual Session 1 (Western Time Zone)

Chair: **Carlos Duque** (*Universidade Federal de Juiz de Fora*)

Tuesday 31 May, Room: V

- 1600 1615 **The Difficulty to accurately assess the Active Losses due to Harmonics** *Costea, Marian; Leonida, Tudor*
- 1615 1630 Investigation of harmonic resonance from reactive compensation in hospital electrical installations with magnetic resonance imaging (MRI) Neves Neto, Joao Cardoso; Almeida, Carlos; Delbone, Edval; Starosta, José
- 1630 1645 An investigative study of the application of fundamental operations of mathematical morphology in the diagnosis of oscillatory transients Hoffmann, Alessandra; Beuter, Carlos H; Oleskovicz, Mario
- 1645 1700 Harmonic Selection-based Analysis for High Impedance Fault Location Using Stockwell Transform and Random Forest Lopes, Gabriela N.; Menezes, Thiago S.; Vieira, Jose M.
- 1700 1715 GHG Emissions, present energies, future with storage: Highlight for China, USA and Brasil

Santos, Silverio Penin y; Carvalho, Elias Felipe

1715 - 1730 A 3-phase 4-wire Shunt Active Filter with Selectable Harmonic Compensation and an Auto-Calibration Harmonic Algorithm Bianchin, Carlos; Oliveira, Cretan; Melo, Priscila F.; Schmal, Ricardo; Gati, Victor; Garcia, Flavio; Almeida, Patrick; Maneira, Wiviane

Technical Session 12: Renewable Energy Sources 2

Chair: Fabio Mottola (Università degli Studi di Napoli Federico II)

- Wednesday 1 June, Room: A
- 0900 0915 Analysing Waveform Distortion in Wind Power Plants by a Deep Learning-Based Graphical Tool

Oliveira, Roger; Salles, Rafael S.; Bollen, Math; de Carli, Miguel

0915 - 0930 Power Quality Comparison of Wind Turbines and Oscillating Wave Columns Considering IEC 61000

Nagle, Conor; Kelley, James; Sengor, Ibrahim; Hayes, Barry P.

- 0930 0945 Aggregation of multiple inverter-based harmonic sources within a renewable energy generation plant
 - David, Jason; Robinson, Duane; Elphick, Sean
- 0945 1000 Cable Effects on Noise Propagation in Distribution Networks with Renewable Sources

Wan, Lu; Hamid, Abduselam; Wu, Xinglong; Liu, Xiaokang; Grassi, Flavia; Spadacini, Giordano; Pignari, Sergio; Zanoni, Michele; Chiumeo, Riccardo; Tenti, Liliana

1000 - 1015 Intelligent Low Voltage Regulator for Solving PV Overvoltages Problems in Power Distribution Systems

Ghiani, Emilio; Di Gregorio, Rocco

1015 - 1030 Filter and Controller Identification for Stability Analysis of a Grid-Connected 3-Phase PV Inverter

Iqbal, Zafar; Djokic, Sasa; Meyer, Jan; Mueller, Sascha; Kaufhold, Elias

Technical Session 13: Virtual Session 2 (Eastern Time Zone)

Chair: **Gary Chang** (*National Chung Cheng University*)

Wednesday 1 June, Room: V

0900 - 0915 Quantifying the impact of supply frequency adjustments for DER control on consumer appliances

Elphick, Sean; Robinson, Duane; Knott, Jonathan; Perera, Sarath; Afandi, Nurul Izzah; Wilmot, Nigel

0915 - 0930 International survey on voltage harmonic unbalance in low voltage networks

Yadav, Jayashree Rajaram; Blanco-Castaneda, Ana M; Meyer, Jan; Vasudevan, Krishna

0930 - 0945 Development of Harmonics Measurement System for Energy-Saving Lamps- An Educational Platform

Chen, Y. Y.; Chang, Gary; Li, G. Y.; Chen, H. J.; Wu, J. Z.

0945 - 1000 The Piecewise Probabilistic Model for Aggregate Harmonic Load Based on Measured Data

Ma, Hai Xing; Wang, Ying; Xiao, Xian-Yong; Yang, Shuang; Chen, Yong-Tao; Ma, Xing

1000 - 1015 An Intelligent Active Power Filter to Mitigate Harmonics and Interharmonics

Eslami, Ahmadreza; Negnevitsky, Michael; Franklin, Evan; Lyden, Sarah

1015 - 1030 **A Passivity-based Hybrid Control Strategy for Islanded AC Microgrids** *Yang, Mengling; Wang, Yang; Chen, Song; Xiao, Xianyong*

Technical Session 14: Distortions from Customers' and Suppliers' Side

Chair: Morris Brenna (Politecnico di Milano)

Wednesday 1 June, Room: Aula Magna

- 1130 1145 Utilization of Allocated Harmonic Emission by Customer Installations connected to Low and Medium Voltage Networks Pourarab, Morteza; Domianus, Oliver; Meyer, Jan; Naef, Thomas; Rölli, Roger; Ulrich, Max
- 1145 1200 **Applicability of LED lamps classification methods** *Gutierrez Ballesteros, Elena; Ronnberg, Sarah; Gil de Castro, Aurora*
- 1200 1215 A Practical Approach to Mitigate the Harmonic Distorsion in a Microgrid, Case Study

Muresan, A.; Fati, O.; Czumbil, L.; Ceclan, A.; Jurj, D. I.; Rizzo, Renato; Micu, Dan D.

1215 - 1230 Immunity of Mass-market Electrical Appliances to Harmonic Distortion of the Supply Voltage

Khokhlov, Victor; Moller, Friedemann; Meyer, Jan; Schegner, Peter

1230 - 1245 Including load impedance uncertainity in harmonic impedance seen from a low-voltage customer

Nakhodchi, Naser; Bollen, Math

1245 - 1300 Voltage-Current Ratio Difference Method: Recommended for IEEE Standard 1547 to Determine the Customer Harmonic Contribution Safargholi, Farhad; Malekian Boroujeni, Kia; Santjer, Fritz

Technical Session 15: Light Flicker and Voltage Fluctuations

Chair: Jiri Drapela (Brno University of Technology)

Wednesday 1 June, Room: A

- 1130 1145 **IEC Flickermeter Measurement Results for Distorted Modulating Signal** while Supplied with Distorted Voltage *Kuwalek, Piotr*
- 1145 1200 Flicker dependency on voltage fluctuation at frequencies greater than power frequency
 - Michalski, Mateusz; Wiczynski, Grzegorz
- 1200 1215 Response of Flicker Assessment Algorithms to Interharmonic Distortion Patterns

Kukacka, Leos; Drapela, Jiri; Meyer, Jan; Stiegler, Robert

- 1215 1230 Modified Method of Detecting Rapid Voltage Changes in a Medium Voltage Network Lofgren, Isabelle; Gutierrez Ballesteros, Elena; Ronnberg, Sarah
- 1230 1245 Decomposition Problem in Process of Selective Identification and Localization of Voltage Fluctuation Sources in Power Grids Kuwalek, Piotr
- 1245 1300 New Comprehensive Analytical Model of Single-phase AC/DC Diode Rectifiers in the presence of Interharmonics in Supply Voltage Langella, Roberto; Testa, Alfredo; Vendemia, Vincenzo; Drapela, Jiri

Technical Session 16: Power Quality Analysis

Chair: Adam J. Collin (Universita degli Studi del Sannio)

Wednesday 1 June, Room: B

1130 - 1145 Development of a Power Dependent Frequency Domain Model of an Inverter-driven Heat Pump

Collin, Adam; Langella, Roberto; Testa, Alfredo; Yanchenko, Sergey

- 1145 1200 Survey of voltage unbalance and unbalanced power in German public LV networks
 - Moller, Friedemann; Meyer, Jan
- 1200 1215 Geometric Power and Poynting Vector: a Physical Derivation for Harmonic Power Flow using Geometric Algebra Montoya, Francisco G.; Arrabal-Campos, Francisco M. ; Alcayde, Alfredo A.; Prado-Orban, Xabier; Mira, Jorge
- 1215 1230 Determination of Instantaneous Powers from a Novel Time-Domain Parameter Identification Method of Non-Linear Single-Phase Circuits Montoya, Francisco G.; De Leon, Francisco; Arrabal-Campos, Francisco; Alcayde, Alfredo A.
- 1230 1245 Multi-objective Optimization Aiming to Minimize the Number of Power Quality Monitors and Multiple Fault Estimations in Unbalanced Power Distribution Systems

Martins, Paulo E; Oleskovicz, Mario

1245 - 1300 Harmonic Resonance Characteristics of a residential low voltage distribution Network considering typical Variations of Grid and Customer Characteristics Scholtz, Stephan; Kannan, Shrinath; Meyer, Jan

Social Events

Welcome Reception

18:30 - 20:00, May 29th Circolo Canottieri, Via Molosiglio 1, Napoli

The welcome reception will be held in the grounds of the Circolo Canottieiri, one of the most prestigious and renowned nautical clubs in Italy. The welcome reception venue is located in the green oasis gardens of "Molosiglio" in San Ferdinando, overlooking the bay of Naples, on one of the most beautiful beaches and marinas of the city.

Tour

16:50 - 20:00, May 30th Naples Historical Centre, UNESCO Word Heritage Site

The meeting location for the tour is the entrance of the Conference Venue.

A guided walking tour around one of most important historical centres in Europe. The Centro Storico, a UNESCO World Heritage Site since 1995, attracts visitors from all over the world due to its diverse and extensive collection of squares, churches and obelisks. The guided tour will stop at the major sites of interest and offers to the opportunity to learn about this ancient city, once the largest city in Europe, whilst walking down the ancient Cardo and Decumano (greek-roman road layout of the city) and taking in Piazza del Gesù Nuovo and Piazza San Domenico Maggiore.



Conference Dinner

20:00 - 23:00, May 31st Villa Doria d'Angri, Via Francesco Petrarca 80, Napoli

A transfer service from the conference venue area to the Villa will be provided. The bus will leave at 19:30 from outside the Grand Hotel Vesuvio located on the same street as the conference venue.

Transfer back to the conference venue will be provided at the end of the dinner.

Villa Doria d'Angri is the most important neoclassical mansion in Posillipo hill, the area of Napoli preferred by Roman aristocrats for its stunning views over the Bay of Naples. The villa was commissioned by Prince Marcantonio Doria d'Angri (1809-1837) to the architect Bartolomeo Grasso (1773-1835), who completed the construction in 1833.

This monumental villa is the expression of the greatest artists and artisans of the time. It gleams in all its ancient splendour and features a park with a total area of over 18,000 square metres. Since 2000, Villa Doria d'Angri has hosted the Naval Museum of the University of Parthenope. The Museum includes a collection of approximately 160 ship models and navigation tools dating back to 1920, the year the University was founded.



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We solve electric power quality and harmonic challenges for tool vendors and fabs throughout the world. 40 years of success at hundreds of fabs in 17 countries.

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Engineering consultant Alex McEachern is known worldwide for his cheerful, practical, hands-on approach to explaining how to solve electric power challenges.



Schneider's purpose is to empower all to make the most of our energy and resources, bridging progress and sustainability for all. We call this Life Is On.

Our mission is to be your digital partner for Sustainability and Efficiency

We drive digital transformation by integrating world-leading process and energy technologies, end-point to cloud connecting products, controls, software and services, across the entire lifecycle, enabling integrated company management, for homes, buildings, data centers, infrastructure and industries.

We are the most local of global companies. We are advocates of open standards and partnership ecosystems that are passionate about our shared Meaningful Purpose, Inclusive and Empowered values.



TeamWare – Solutions for a smarter energy

TeamWare specializes in designing and manufacturing electronic equipment and systems for electrical grids monitoring and control, offering a qualified portfolio of innovative solutions:

- Power quality, with a leading position in wide-area distributed power quality monitoring systems for DSO and TSO
- HV/MV and MV/LV substation automation equipment
- Automated energy metering systems

All TeamWare's products comply with world-acknowledged regulations at the highest levels of performance and severity.

Our mission: The best technology at the best value

Achieving corporate targets is guaranteed by the high professionalism of the staff, as the result of three decades of experience in working with companies operating in advanced technology in measurement, control and automation sectors.

Professional fairness and reliability in relationships with customers are achieved targets.

Our values

Great passion, investment in research, state-of-the-art technology, expertise and professional service are the key factors that made TeamWare a fair and reliable partner to accompany large and small grid operators worldwide in a smarter, cyber-secure and sustainable energy transition.

Why TeamWare

- Reliability: for more than thirty years on the market, constantly growing
- Quality: expertise, professionalism, ongoing commitment.
- Support: direct and immediate contact between our technicians and customers.
- Complete solutions: 360° expertise, products and systems integrated and effective.



Terna group is the owner of the Italian national transmission grid (NTG) for high and extra-high voltage power and is the largest independent electricity transmission system operator (TSO) in Europe. We are responsible for planning, developing, maintaining and dispatching the power flows through the NTG. Featuring total investment of \in 9.5 billion, the "Driving Energy" Industrial Plan for the period 2021-2025 sets out Terna's commitment to supporting the country recovery from the pandemic and strives to achieve the goals set in the European Green Deal and in the National Integrated Energy and Climate Plan. The ten-year Development Plan 2021 envisages investment in grid infrastructure amounting to over $\in 18$ billion.



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VOLTA was founded in 1952 and started out as a service company, quickly developing into a commercial and representative company.

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VOLTA specializes in state-of-the-art technical solutions through the distribution and technical support of high-quality products. Respect, efficiency and effectiveness are always at the forefront for us.

Our Values

- Constance
- Respect
- Responsibility
- Effectiveness and efficiency
- Solution-oriented
- Enthusiasm
- Competence

Our Goals

Our aim is to be able to take pride, together with our customers and suppliers, in the equipment and products we supply, in the services we offer and in the advice we provide in order to arrive at the best solution.



Elettra srl is a company that offers its customers design, installation and maintenance services for LV, MV and HV electricity distribution systems. It also designs and builds testing rooms and Faraday cages, plants from renewable sources and provides "turnkey" Industrial Automation solutions.



MA.DE. Engineering is a company authorized by the MiSE for the safety checks of electrical systems with over 50 years of experience in the electrotechnical field. Company's metrology laboratory carries out the electrical measuring instruments and energy meters calibration; MVE department is high qualified for electrical measurements and tests.

P 🥌 W E R S I D E "

Powerside is a global manufacturer and supplier of Power IntelligenceTM monitoring and remediation solutions for commercial, industrial, and utility customers. Powerside designs and manufactures highly accurate and easy-to-install power quality monitoring instruments, power factor correction and harmonic filtering solutions, including low and medium voltage capacitor banks and active harmonic filters.

Host Universities

University of Naples Federico II

Host Department: Department of Electrical Engineering and Information Technology

The University of Naples is named after Federico II (Frederick II), to underline its ancient origins dating back to June 5, 1224, when the Holy Roman Emperor and King of Sicily founded the institution to train secular administrative staff of the Empire.

It is recognised as the world's oldest state university and is the third university in Italy by number of enrolled students (80,000). It is organized in three semi-independent divisions – the Division of Science and Technology, the Division of Life Sciences and the Division of Social and Human Sciences – which are responsible for the research and teaching of 26 different departments. Over the years the University of Naples has had several venues, with three major campuses – one in central Naples, one in the Fuorigrotta district in the west and one on the hill of Camaldoli in the north.

In the long history of the University of Naples Federico II there have been some very influential alumni, including philosopher and theologian Saint Thomas Aquinas who not only studied but later taught at the university. Other notable alumni include former Italian presidents Giovanni Leone, Enrico De Nicola and Giorgio Napolitano.



University of Campania Luigi Vanvitelli

Host department: Department of Engineering

The University of Campania Luigi Vanvitelli, formerly the Second University of Naples, is named after Luigi Vanvitelli, the renowned Italian architect and engineer who designed, amongst others, the Baroque-Italian Neoclassical Royal Palace of Caserta, the largest royal palace in the world by volume. The University was established in 1991 and officially opened on November 1, 1992. Currently there are nearly 24,000 students and 16 Departments located in five territorial areas:

- Aversa with the Departments of Engineering, Architecture and Industrial Design
- Caserta with the Departments of Mathematics and Physics, Psychology, Political Science, Environmental, Biological and Pharmaceutical Sciences and Technologies
- Santa Maria Capua Vetere with the Departments of Law Humanities and Cultural Heritage
- Capua with the Department of Economics
- Naples with the School of Medical Sciences and the Departments of Precision Medicine, General and Specialised Surgery for Women and Children, Experimental Medicine, Multidisciplinary Department of Medicine for Surgery and Orthodontics, Mental, Physical Health and Preventive Medicine, Cardiothoracic and Respiratory Sciences, Medical, Surgical, Neurologic, Metabolic and Aging Sciences.

The University departments are housed in historical complexes in the Campania region. Many of these buildings, once monasteries, convents, abbeys with cloisters from the 18th-19th Century, have been restored to their former glory and given a new lease of life as part of the careful development work of the University.



University of Naples Parthenope

Host department: Department of Engineering

The origins of the University of Naples Parthenope can be traced back to 1919, when – upon request of Vice Admiral Pasquale Leonardi Cattolica, founder of the University – an institute of higher education, the Royal Naval Institute, was created with the aim of pursuing scientific developments covering all aspects of oceans and seas: from marine life to the use of the sea as a system of trade and associated economic issues. In 1999, the two long-standing Faculties of Economics and Nautical Science (later renamed Science and Technology) were aggregated to form three new Faculties, namely Law, Engineering and Sports Science.

In 2001 the Institute officially became the University of Naples Parthenope. From July 2013, a new set of study curricula and a department-based organization were introduced.

The new organization develops both research and teaching activities, with an emphasis on the promotion, development, direct application, enhancement and use of knowledge to contribute to the social, cultural and economic development of society. These changes have led to a significant growth in the number of students, from about 1,000 in 1985 to around 16,000 today.

In the hundred years since its foundation, the most profound and characterizing trait of this University remains unchanged and true to the vision of its founder: the ability to interact with the social context and to continuously engage with its evolving demands.



Conference Center

Centro Congressi Federico II

Via Partenope, 36, 80121 Napoli NA

The conference will be held in the purpose built Conference Center of the University of Naples Federico II. The facility is located in the centre of a large pedestrianized area of the bustling Naples promenade, which features numerous restaurants and bars and offers stunning views over the Bay of Naples, the Sorrento Coast and the Island of Capri, while still being within easy reach of the rest of the city.

The layout of the Conference Center is shown overleaf. The sessions will be held in the Aula Magna (located on the 1st floor) and Room A and Room B (both located on the ground floor). Coffee breaks and lunch will be held in the catering area on the ground floor. The exhibitors display area is also located on the ground floor.

The registration area is located on the ground floor close to the entrance. The registration desk will be staffed during the hours of the conference: Sunday 14:00 -18:00, Monday 08:00 - 16:50, Tuesday 08:30 -17:30 and Wednesday 09:00 - 13:30.

WiFi Access for Conference Participants

Wi-Fi SSID: guestpartenope Password: xs404cnv22





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