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GSPEE2023

2nd Global Summit on Power and Energy Engineering

March 20-21, 2023 **Rome, Italy**

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FOREWORD

Dear Colleagues,

It is a great pleasure to announce that The Scientistt will host the 2nd Global Summit on Power and Energy Engineering (GSPEE2023) will be held in Rome, Italy during March 20-22, 2023.

GSPEE2023 aims to bring together the renowned researchers, scientists and scholars to exchange ideas, to present sophisticated research works and to discuss hot topics in the field and share their experiences on all aspects of Power and Energy Engineering.

The GSPEE2023 will be a 3 days event that means to gather the key players of the Power and Energy Engineering community and related sectors. This event is launched with the aims to become an established event, attracting global participants, intent on sharing, exchanging and exploring new avenues of Power and Energy Engineering-related scientific and commercial developments.

A wide-ranging scientific program consisting of plenary lectures, keynote lectures, Invited lectures, parallel sessions, as well as poster sessions for young scientists covering all topics in Power and Energy Engineering will be scheduled. This conference provides a wonderful opportunity for you to enhance your knowledge about the newest interdisciplinary approaches in Power and Energy Engineering.

Moreover, the conference offers a valuable platform to create new contacts in the field of Power and Energy Engineering, by providing valuable networking time for you to meet great personnel in the field.

We look forward to seeing you at GSPEE2023 in Rome, Italy.

COMMITTEES

Organizing Committee

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Plenary Forum Day-1

G.Z. Kyzas*

A.Varoutoglou[1], D.A. Lambropoulou[2], A.C. Mitropoulos[1], and G.Z. Kyzas*

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[2]Department of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece.

Energy-Effective Decontamination of Diclofenac in Pharmaceutical Effluents with Nanobubbles Technology

Abstract

The aim of this presentation is to remove a pharmaceutical substance Diclofenac from an aqueous tap water solution. During the experimental procedure, an oxidation method of nanobubble technology was applied, where three different gases, atmospheric air, oxygen and ozone were used. The nanobubble generator used for the experiments applies the hydrodynamic cavitation method, through special geometries inside the generator, to achieve the decomposition of the gas phase and the creation of nanobubbles with an average diameter of 100 to 200 nm and a high concentration of 5×108 particles/mL. The oxidative behavior of the nanobubbles, was studied in three different environments, acidic at pH 3, basic at pH 7.5 and alkaline at pH 12. The concentrations of Diclofenac used during the experiments were 5, 10 and 15 mg/L. The flow rate of gases introduced into the aqueous solution for the formation of nanobubbles was 0.3-0.7 and 1.2 L/min. The experimental oxidation process had a duration of 50 min where every 5 min the sample was collected. The measurements of the collected samples were taken in a spectrophotometer (UV) to measure the decrease in concentration of the drug substance. The results of the sample measurements showed that the atmospheric air and oxygen, remove the pharmaceutical substance from the aqueous solution at a rate of 2% to 18%, depending on the initial concentration of Diclofenac. Ozone achieves a high rate of reduction of Diclofenac from 45% to 98% from the aqueous solution. It was found from the experimental results that the increase in the removal rate of Ibuprofen depends on the supply of ozone introduced into the aqueous solution.

Keywords

Wastewaters; Nanobubbles; Pharmaceuticals;

Acknowledgment

The financial support received for this study from the Greek Ministry of Development andInvestments (General Secretariat for Research and Technology) through the research project“Research-Create-Innovate” with the topic “Development of an integration methodology fortreatment of micropollutants in wastewaters and leachates coupling adsorption, advanced oxidationprocesses and membrane technology” (Grant no: T2EΔK-04066) and it is gratefully acknowledged.

Biography

Dr. George Z. Kyzas is a Full Professor at the Department of Chemistry at the International Hellenic University (IHU). He is now working at the Department of Chemistry (International Hellenic

University, Kavala, Greece), being the Head of the Department (since 2019).His research interests include the synthesis and characterization of various (majorly adsorbent) materials (inorganic, aluminates, polymers, graphene, activated carbons, agro-food residues, nanomaterials, CNTs, etc.) for environmental applications (wastewaters treatment).His scientific work has been published in more than 235 Papers in international journals, while he published 8 Books, 39 Chapters in scientific Books and holds 3 Patents. His work is widely recognized with 15,000 Citations (h-index 65). He is the Editor of the journal “Environmental Science and Pollution Research” (Springer, IF 5.190). His name is included in the list of World Top 2% Scientists for 2019, 2020 and 2021 which is compiled by the Stanford University (USA) based on standardized citation indicators. His name is included in the list of Highly Cited Researchers for 2022 (Thomson Reuters - Clarivate WoS)

Prof. Rufer Alfred

Ecole Polytechnique Federale De Lausanne, Switzerland

Innovative Technology for Compressed Hydrogen – Efficient H2-Refueling Station

Abstract
Compressed Hydrogen for automotive H2 refuelling stations is conventionally produced by air-driven gas boosters. This alternating piston compressors suffer from the very poor energetic efficiency of their compressed air actuators, and further from the whole chain of providing the compressed air. A dedicated electromechanically driven gas booster is presentedwith a significant increase of the efficiency, and where the strong power fluctuations are compensated with an added active power compensator.

Another limitation of gas boosters applied for high pressure is the elevation of the temperature inside the compression cylinders.As a solution to this problem, an original concept of a finned piston is proposed, with which the compression process can be realized in nearly isothermal conditions. Beneath the effect of limiting the heat-up of the pistons and of the seals, the nearly isothermal compression brings another increase of the energetic efficiency.

Biography
Alfred Rufer received a Master's degree from the Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland, in 1976. From 1976 to 1978, he was a research assistant with EPFL's Chair of Industrial Electronics (Prof. H. Bühler). In 1978, Alfred Rufer joined ABB, Turgi, Switzerland, where he worked in the fields of power electronics and control for high-power variable frequency converters for drives. A Rufer has participated in several development teams on new applications of power electronics, like renewable energies. In 1985, he was a Group Leader for power electronics development at ABB. 1993 he became an Assistant Professor at EPFL. Since 1996, he was elected as a Full Professor and Head of the Industrial Electronics Laboratory at EPFL. The research activities of Alfred Rufer concern power electronic circuits and control, modelling of energy devices interfaced to power converters, energy storage, compressed air energy storage. Alfred Rufer has several patents and is the author of many publications on power electronics and applications. Alfred Rufer is author of a book on Energy storage, Systems and Components CRC Press). In the year 2006, A. Rufer was elected at the IEEE Fellow grade. From March 1st 2016 Alfred Rufer is retired, and gets the title of Professor Emeritus.

Evgueniy Entchev

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Hybrid Energy Networks – a Concept for Large Renewables and Hydrogen Utilization

Abstract
In the last decade, the energy security and energy supply in any form becomes one of the main priorities of governments around the world. Energy resources diversification and proper mix of energy generation capacities and renewables become crucial to achieve sustainable energy future, driving the change of how we generate, transport, store and use energy. The reliable supply of green natural gas, clean electricity and inexpensive heat are of the main and primary concerns to meet the climate and environmental targets by 2050. The current energy systems are designed using a centralized model or "one to many"concept where a large centralized power/gas/thermal station is connected to a network to deliver energy to the end user. The obvious topology and operational similarities among the networks offer great economic advantage of scale but become a barrier for large renewable energy resources penetration on the networks due to their limited expansion capacities. At the same time the electricity, heat and gas networks are dynamic space/time systems. Hybrid energy networks is a new concept that allows integration of various energy networks - electricity, gas and heat into one network under common ICT to allow better management, efficient utilization and increased participation of distributed generation and renewables. The commonality among the energy vectors leads to assets sharing, common intelligence and energy supply risk mitigation. It also opens the space for novel applications of crosscutting technologies such as Power to Gas, various decentralized microgeneration technologies and electrified transportation. The lecture will discuss the hybrid energy networks concept and its components, especially the ones related to hydrogen generation, utilization, and various applications of artificial intelligence for network management. The impact of this approach on larger renewables and advanced energy technologies penetration on lowering the GHG emissions while improving the networks utilization factor will be discussed.

Biography
Dr. Entchev holds B. Eng. degree in nuclear engineering, M. Sc. degree in applied mathematics and a doctorate for studies of time series, stochastic analysis, simulation and optimization of large energy systems. Dr. Entchev has many years of experience as university professor and scientist in the field of variety of energy systems from renewable technologies to nuclear reactors. His primary research interests lie in the implementation of novel advanced technologies and performance optimization techniques aimed at lowering the greenhouse gas emissions and increasing the efficiency and sustainability of conventional and renewable energy systems. Dr. Entchev has chaired and has been invited speaker at numerous International scientific conferences; he chairs IEA multi disciplinary research committees and working groups dealing with the environment, new energy technologies development and implementation. Overall, Dr. Entchev has authored/co-authored 5 books, published more than 500 papers and articles and has given numerous seminars and workshops to major international organizations and professional associations.

Christos N. Markides

Clean Energy Processes (CEP) Laboratory, Department of Chemical Engineering, Imperial College London, U.K.

High-Efficiency Integrated Hybrid Solar Heating, Cooling and Power Systems for Distributed Applications

Abstract
By 2050, solar technologies are projected to deliver the majority of the world's electricity. Although solar energy can be used to provide either heat or electrical power, most solar panels are designed for only one of these purposes. In particular, photovoltaic (PV) panels are typically less than 20% efficient in delivering electricity from the sun's energy with the remainder lost as waste heat. At the same time, it is well known that PV cells experience deterioration in performance (efficiency) when they are operated at higher temperatures, and that this leads to high losses especially when the solar resource is at its highest. A drop in PV cell efficiency of up to 20% can be expected when the PV cells reach operating temperatures of ~60-70 °C, which is easily experienced in hot climates.

This performance loss has motivated the development of so-called 'hybrid' PV-thermal (PV-T) solar collector technology, which combines PV modules with a contacting fluid (gas or liquid) flow in various different geometries and configurations. Here, the fluid is used to cool the PV cells and, therefore, to increase their electrical efficiency, while delivering a potentially useful thermal output (hot fluid stream) from the collector, which offers some advantages when space is at a premium and there is demand for both heat and power. PV-T collectors have been shown to be a highly efficient technology, capable of achieving system efficiencies (electrical plus thermal) in excess of 70%.

By far the most common use of the thermal-energy output from PV-T systems (in fact most solar-thermal collector technologies) is to provide hot water at 50-60 °C for households or commercial use. However, a wide range of opportunities arise at higher temperatures when additional power-generation cycles (e.g., with organic Ranking cycles, thermoelectric generators, amongst other) or thermally-driven cooling technologies (e.g., with desiccant, ad/absorption refrigeration cycles, amongst other) can be integrated with solar (including PV-T) collectors into wider multi/polygeneration systems. These additional options become viable at temperatures typically above ~80 °C, and importantly, become increasingly efficient at progressively higher temperatures.

In standard PV-T collector designs, however, the electrical and thermal outputs are traded-off each other, since any effort to collect additional thermal energy or to increase the temperature of that energy leads to an electrical loss. This has led recently to the proposal of collector designs that can deliver useful heat at a high temperature while not sacrificing the electricity output. In this talk we will present conventional and such advanced PV-T collector designs, their underpinning principles, discuss the challenges and opportunities of further developing this technology, and of integrating it within wider solar-energy systems capable of the affordable provision of cooling, heating and power.

Biography

Christos Markides is Professor of Clean Energy Technologies, Head of the Clean Energy Processes Laboratory, and leads the Experimental Multiphase Flow Laboratory, which is the largest experimental space of its kind at Imperial College London. He is also, amongst other, Editor-in-Chief of journal Applied Thermal Engineering, a member of the UK National Heat Transfer Committee, and on the Scientific Board of the UK Energy Storage SUPERGEN Hub. He specialises in applied thermodynamics, fluid flow and heat/mass transfer processes as applied to high-performance devices, technologies and systems for thermal-energy recovery, utilization, conversion or storage. His research interests include heating, cooling and power, and in particular, solar energy and waste heat recovery and conversion in heat-intensive industrial applications. He has published about 300 journal and >350 conference papers on these topics. He won IMechE's 'Donald J. Groen' outstanding paper prize in 2016, IChemE's' Global Award for Best Research Project' in 2018, the Engineers without Borders 'Chill Challenge' in 2020, and received Imperial College President's Awards for Teaching in 2016 and Research Excellence in 2017

Keynote Forum
Day-1

Daniel Favrat
ExerGo Sàrl, Switzerland

Efficient Trigeneration and Storage: Key Elements for a more Sustainable Energy Transition

Abstract
Following the Paris protocol and the most recent IPCC warnings, increasingly ambitious objectives towards a carbon free society are being proposed. Hence the need for more integrated systems to efficiently meet the essential energy demands for comfort and electricity.

Technologies for the trigeneration of heat, cold and electricity and exploiting synergies at the building or district level will play a growing role. In particular the combination of SOFC fuel cells with or without separation of CO2 together with heat pumps are potentially "game changers" with an expected jump in efficiency. Those silent and emission free technologies can be particularly attractive to couple with the existing gas network investment to valorize natural gas NG (including synthetic gas SNG) from biomass or power to gas technologies.

Apart from cost, the energy efficiency indicator is also used for comparing the main technology options together with the share of renewable energy supply particularly at the district level. Furthermore, and to better match supply and demand, energy storage options both at the daily or seasonal time scales will also be briefly reviewed with an emphasis on synthetic fuels that will be needed to cope with the seasonal variations in low carbon societies. New generations of district heating and cooling networks will also be compared both in terms of efficiency and footprint.

Biography
Daniel Favrat is professor emeritus at Ecole PolytechniqueFederale de Lausanne (EPFL) and former director of EPFL Energy Center. Previously he was director of the Industrial Energy Systems Laboratory of EPFL for 25 years, director of EPFL Institute of energy sciences for 6 years as well as member of the Swiss Science Council and of the steering committee of its technology assessment group for 4 years. At EPFL he initiated and led the "energyscope.ch" platform with a calculator of scenarios for the Swiss energy transition by 2050. For 10 years he was a member of CORE, the committee advising the Swiss government on energy research and demonstration.

He was also an external member of the research committee of the Paul Scherer Institute and Swiss representative at the ESFRI-ESWG (Energy Strategy Working Group of the European Strategy Forum on Energy Infrastructure) from 2011 to 2015. He was the president of the program committee of the 4th World Engineering Convention in Geneva specifically dealing with Energy.

In the course of his career he spent sabbatical leaves in major universities (MIT, TU Muenchen, University of Tokyo, Ecole des Mines Paris. Prior to joining EPFL he worked for 10 years in industrial energy research centers in Canada and Switzerland. His research includes systemic analyses in what is called environomics (a contraction of energy, environment and economics) for a more efficient design of integrated technologies based on both fossil and renewable energies.
He also contributes to the design of advanced equipment for a more rational use of energy including heat pumps, fuel cells, solar power plants and district heating and cooling networks. He is presently vice-chairman of the energy committee of the World Federation of Engineering Organizations (WFEO), a member of the editorial board of Energy: the international Journal and of the International Journal of thermodynamics. He is also a member of the Swiss Academy of Engineering Sciences and of the French National Academy of Technologies.

He is cofounder of ExerGo.ch, a startup company developing a revolutionary district heating and cooling system and a fellow of Presans.com a leading open innovation consulting firm located in Paris.

He is co-author of several books and patents in the field of energy as well as of numerous research papers. In the last 2 years he presented invited conference keynotes in Melbourne, London, and Copenhagen, Vesteras (Sweden) on subjects dealing with sustainability, energy storage and district energy systems.

Anna Pinnarelli

Department of Mechanical, Energy and Management Engineering University of Calabria
Arcavacata of Rende – Cosenza, Italy

Electric Vehicles and Hydrogen in the Framework of the Renewable Energy Communities

Abstract
In December 2019, the European Commission presented the European Green deal, the plan to make Europe climate neutrality by 2050. As an intermediate step (Fit for 55), the EU has raised its climate ambition for 2030, pledging to reduce emissions by at least 55% by 2030. EU aspires to become the first continent to remove at least as much CO2 from the atmosphere as it produces by 2050! According to the latest IPCC report (Intergovernmental panel on climate change) it is much cheaper to cut emissions immediately, using renewables instead of coal, gas and oil, than to remove them later.
The development of technological solutions for energy storage (such as batteries, hydrogen, synthetic gas, etc.) and advanced technologies for applications in smart grids and for Power to Gas, will allow to accelerate the process of smartisation of integrated energy networks, favoring the deep decarbonisation of the national and European economic system.

It is essential to highlight how the presence within the aggregation of recharging infrastructures that use Vehicle one grid (V1G – unidirectional power flow) and the vehicle to grid (V2G – bidirectional power flow) technologies presents itself as an extremely valid solution in terms of application of the "demand side flexibility" paradigm and allows EVs to be considered as "storage systems on wheels" and therefore capable of absorbing and suppling energy when connected to the network.

In this framework the role of hydrogen is essential as an energy vector to decarbonize sectors with high energy demand. A growing integration of electricity and gas networks, sector coupling, will make it possible to pursue the objectives of safety and flexibility of the energy system, allowing the transition from one energy carrier to another. The hydrogen produced can be used locally in an industrial process, in a refueling station intended for mobility, or it can be stored for later conversion into electricity with fuel cells. The hydrogen produced can be used locally in an industrial process, in a refueling station intended for mobility, or it can be stored for later conversion into electricity with fuel cells.

At this scope, the objective is to maximize economic, environmental and social benefits to design and implement smart microgrids operating in the framework of the Renewable Energy Communities as regulated (European directives 2018/2001 of 11 December 2018 (RED II) and 2019/944 of 5 June 2019 (IEM) which maximize the use of RES and exploits the hydrogen supply chain (from production, distribution, use (Power to Gas) and conversion into electricity (Power to Power)).

Biography
Since 2007 Anna Pinnarelli is Assistant Professor at the DIMEG of University of Calabria, Italy. Research activity has been mainly focused on: analysis, modeling and simulation in Matlab-Simulink and Ansys Simplorer environments of integrated hybrid systems (from converters to conventional and non-conventional storage technologies); definition and implementation of management models for aggregate systems within the electricity market; development and implementation of enabling technologies for Smart Grids: Smart Meters, electronic power converters for interfacing with the

IAFR network, storage systems or IAFRs equipped with storage, designed to operate in aggregate form in order to govern the power flows in the networks and peer to peer power exchanges between them; micro-cogeneration systems based on the use of linear synchronous generators driven by Stirling free piston engines; nanoGrid for Home Application intended for the creation of hybrid power systems capable of integrated all-in-one photovoltaic generators, wind microgenerators, storage systems, special converters for V2H & H2V applications suitable for both off grid and grid Connected applications; implementation and application of models and algorithms for Demand Response in the Smart Grid environment; Implementation of control systems for nano Grid to be used for the creation of mini-Grids or micro-Grids with DC or AC distribution; implementation of Energy Management System (EMS) for the management and control (through the use of nano Grid) of the power flows in the distribution networks within the “energy communities” and the exchange of energy between Consumer, Prosumer, Consumage (r), Prosumage (r) of the same “energy community” (aggregate systems). The research activity is associated with an intense experimentation activity in the laboratory and in the real-life application which has led to the creation of several laboratory prototypes of enabling technologies in the field of smart grids such as nano grids, smart meters and smart PV lighting systems and of a test-facility installed at the campus of University della Calabria.

During the research activity there were several technical and scientific exchanges/collaborations with industries of the electrical engineering area, such as for example: SIEL, FAAM, EnelX. As an expert, (since 2013) she is a technical consultant on behalf of Italian Authority ARERA, for the evaluation of the system research projects – RdS. She collaborates with the University of Technology, Wrocaw, Poland and the University of Zaragoza- Zaragoza, Spain, as well as with the research institutes Enea and CNR. Since 2020, she is representative of UNICAL partner within H2020 BRIDGE - Cooperation group of Smart Grid, Energy Storage, Islands and Digitalization H2020 projects. She is acting as Work Package Leader in several National projects. She is the Scientific Coordinator for the Unical partner of the H2020 Project E balance plus. She also acts as Lead and guest editor for special issues associated with international scientific journals, and she has been plenary speaker in several scientific conferences, chair in international conferences and member of scientific committees. She is the author of many scientific papers published in international journals and proceedings of international conferences. She is a co-author of the National industrial patent BI2638M “DISPOSITIVO ELETTRONICO DI CONTROLLO DI UN MOTORE STIRLING DI TIPO FREE-PISTON CON ALTERNATORE LINEARE E RELATIVO METODO DI CONTROLLO”, n° 102016000065916.

She is a member of the Scientific and Technical Council of the Consortium CRETA (Regional Consortium for Energy and Environmental Protection) as well as one of the founders of Spin-off Academic CRETA Energie Speciali Srl operating in the field of renewable energy sources. She is member of the Scientific and Technical Committee of Polo d’Innovazione Ambiente e Rischi Natural - NET, having as trajectories: techniques, products and devices for the analysis and assessment of hydrogeological risk and other environmental risks; devices, sensors and solutions for the earthquake protection of the territory; early warning systems and emergency management related to environmental risks; new energy technologies and reuse of scraps and waste to reduce the environmental impact. Since October 2017 she is appointed by the Regione Calabria, as technical expert and support the activity of the Head of the Procedure having the specific technical skills, as part of the implementation of the “Sistema di collegamento metropolitano tra Cosenza, Rende e Università della Calabria”. She is carrying out teaching activities in the energy engineering degree courses and in several Masters in the field of smart grids and power electronic converters. She is director of the Master in Sustainable Mobility and Infrastructure Engineering (MIMI Calabria) of the University of Calabria.

Ralph M. Kennel, Eyke Aufderheide
Technical University of Munich, Germany

Abstract
The UltraZohm is a powerful real-time computation platform for research, development, and rapid-control prototyping of power electronics and drive systems that facilitates the implementation of model predictive control algorithms as well as sensorless control methods. Development is driven by researchers for researchers to establish a common control platform. Having a common platform enables the active research community to focus on publication and results, while platform development is a shared effort. The system is centered around Zynq UltraScale+ MPSoC which offers computational power based on an FPGA and several ARM cores. The hardware concept is designed to be fully modular and adaptable.

This talk will cover the motivation to create open-source and open-hardware systems in the science community and discuss its applicability in the field of control of power electronics and drives.

Biography
Ralph M. Kennel was born in 1955 at Kaiserslautern (Germany). In 1979 he got his diploma degree and in 1984 his Dr.-Ing. (Ph.D.) degree from the University of Kaiserslautern. From 1983 to 1999 he worked on several positions with Robert BOSCH GmbH (Germany). Until 1997 he was responsible for the development of servo drives. Dr. Kennel was one of the main supporters of VECON and SERCOS interface, two multi-company development projects for a microcontroller and a digital interface especially dedicated to servo drives. Furthermore he took actively part in the definition and release of new standards with respect to CE marking for servo drives. Between 1997 and 1999 Dr. Kennel was responsible for “Advanced and Product Development of Fractional Horsepower Motors” in automotive applications. His main activity was preparing the introduction of brushless drive concepts to the automotive market.

From 1994 to 1999 Dr. Kennel was appointed Visiting Professor at the University of Newcastle-upon-Tyne (England, UK). From 1999 - 2008 he was Professor for Electrical Machines and Drives at Wuppertal University (Germany). Since 2008 he is Professor for Electrical Drive systems and Power Electronics at Technische Universitaet Muenchen (Germany). His main interests today are: Sensor less control of AC drives predictive control of power electronics and Hardware-in-the-Loop systems. Dr. Kennel is a Senior Member of IEEE, a Fellow of IET (former IEE) and a Chartered Engineer in the UK. Within IEEE he is Treasurer of the Germany Section as well as Distinguished Lecturer of the Power Electronics Society (IEEE-PELS). Dr. Kennel has received in 2013 the Harry Owen Distinguished Service Award from IEEE-PELS, the EPE Association Distinguished Service Award in 2015 as well as the 2019 EPE Outstanding Achievement Award. In 2018 Dr. Kennel received the Doctoral degree honoris causa from Universitatea Stefan cel Mare in Suceava (Romania). Dr. Kennel was appointed “Extraordinary Professor” by the University of Stellenbosch (South Africa) from 2016 to 2019 and as “Visiting Professor” at the Haixi Institute by the Chinese Academy of Sciences from 2016 to 2021.

Invited Forum
Day-1

Marilisa Botte
Federico II University of Naples, Italy

Smart and Sustainable Mobility against the Global Climate Change

Abstract
Making our urban and metropolitan areas increasingly sustainable requires a multidisciplinary approach ranging from circular economy to urban regeneration techniques. Within this context, smart and sustainable mobility plays an important role. The aim is to reduce congestion, air and noise pollution, incidental levels and other transport side effects. Electric vehicles, shared transport modes, MaaS systems, micromobility solutions, as well as connected and autonomous driving, are important tools to be exploited.

Obviously, each one of these options has peculiar pros and cons which are important to be figured out, thus maximising the benefits of each planning decision. For instance, in the case of Maas services deployment, digitalisation and service integration represent significant issues to be addressed.

Among electric transport modes, rail and metro solutions play a key role thanks to their high headways and capacity levels, as well as great speed and efficiency. In particular, they should represent the backbone of the mobility system with sustainable modes available for first/last mile trips. However, they are also very vulnerable to disturbances and disruption events. For this reason, a resilient timetable and a robust rolling stock circulation plan need to be implemented. Simulation and optimisation techniques can be adopted for successfully investigating and planning them, with a great benefit on rail service attractiveness and passengers' satisfaction.

Biography
Born in Caserta, 1988. She holds an MSc degree in hydraulics and transportation systems engineering (2014) and a PhD in civil system engineering (2018), both from Federico II University of Naples, Italy. Currently, she is Assistant Professor at Federico II University of Naples, Italy. She has authored more than 50 papers in peer-reviewed journals and conference proceedings. Her research interests include sustainable mobility, MaaS systems, transportation and urban planning, rail system analysis and management, energy-saving strategies.

Paul Grunow
Trinity Solarbeteiligungen GmbH, Germany

Decentral Hydrogen – The Better Fit?

Abstract
Decentral hydrogen is introduced as fast transition path to short and long-term power storage. It circumvents slow infrastructure installments and enables on-site storage and heat coupling in addition to direct use of local electric power. The power-to-gas approach is extendedto small combined heat and power devices in buildings that alternately operate fuel cells and electrolysis. While their heat is used to replace existing fossil heaters on-site, the power is either fed into the grid or consumed via heat-coupled electrolysis to balance the grid power at the nearest grid node. In detail, the power demand of Germany is simulated as a snapshot for 2030 with 100% renewable sourcing. The standard load profile is supplemented with additional loads from 100% electric heat pumps, 100% electric cars, and a fully electrified industry. The renewable power is then scaled up to match this demand with historic hourly yield data from 2018/2019. An optimal mix of photovoltaics, wind, biomass and hydropower is calculated in respect to estimated costs in 2030. In most master plans,hydrogen is understood to be a substitute for fossil fuels. This talk focuses on hydrogen as a storage technology in an all-electric system. The target is to model the most cost-effective end-to-end use of local renewable energies, including excess hydrogen for the industry. The on-site heat coupling is the principal argument for decentralization here. Essentially, it flattens the future peak from exclusive usage of electric heat pumps during cold periods. Batteries are tried outas supplementary components for short-term storage, due to their higher round trip efficiencies. Switching the gas net to hydrogen is considered as an alternative to overcome the slow infrastructure expansions. Further decentral measures are examined in respect to system costs.

Biography
Paul Grunow has completed his Ph. D at the age of 30 years from Technical University Berlin and Helmholtz-Zentrum Berlin and postdoctoral studies from the COPPE/UFRJ in Rio de Janeiro, Brazil. He is the general manager of Trinity Solarbeteiligungen GmbH, an investment company in renewable energies. Before, he co-founded three companies in the area of photovoltaics based in Berlin, i.e. Solon, Q-Cells, PI Photovoltaik-Institute Berlin. He has published more than 12 papers in reputed journals.

J. L. Shie[3]

M.H. Yuan[1], C. H. Lee[2], J. L. Shie[3*], W.Y. Wang[3], T.C. Chen[4], and Y.H. Chen[5]

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[5]Departments of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei 106, Taiwan.

Supercritical Glycolysis of Waste Biomass for Carbon Materials and Biofuels

Abstract

Hemp bamboo is one of the major crops in Yilan, Taiwan. In order to produce economic crops, bamboo should be regularly managed and thinned. The waste bamboo and other biomass wastes are not accepted to remove by garbage truck, resulting in farmers' disposal, open burning or random composting, etc., and causing air pollution and environmental sanitation problems. Similarly, Yilan is also a huge rice-produced county, and the same problems may be caused while rice straw waste is not properly treated. These biomass wastes are rich in carbon composition of lignin, cellulose and hemicellulose, and are good carbon sources for carbon materials. In this study, using local agricultural wastes (waste bamboo and rice stalks) as raw materials for utilization, and supercritical glycolysis technology (SGT) is conducted for synthesis of high-value biofuels and bio-carbon materials of silicon/carbon. In the generation of electric power, lithium battery materials are the core of electrification, and the improvement of the synthesis method of carbon anode materialsof silicon/carbon in its composition has also attracted huge attention. After the success of amplification from 1L reactor to 10 L pilot plant, the bio-charcan be direct used as bio-solid recovered fuels (BSRF), and further underthe SGT combined with thermal carbon reduction, the silicon/carbon composite material is obtained. Furthermore, the characteristics and feasibility evaluation of the future commercial plant construction is also carried out in this study.

Keywords

Carbon Anode, Silicon/Carbon, Biocarbon, Glycolysis, Hemp Bamboo, Rice Straw

Biography

Je-Lueng Shie received the Ph.D. degree in Graduate Institute of Environmental Engineering from National Taiwan University (NTU), Taiwan, in 2001.In 2004, he joined the Department of Environmental Engineering in National I-Lan University, Taiwan, where he has been a full professor in 2012, and distinguished professor in 2017.Dr. She works in the environmental field of biomass/waste conversion for biofuels, air pollution control and negative carbon technology. Since 2000, He made over 275 scholarly contributions including nearly 95 SCI/EI publications, 127 conference papers, 44 technical reports, 7 patients and 2 technology transfers. In 2013, Dr. Shie was listed as "Engineering Highly Cited Papers World Top 1% (TOP 1%)" by Essential Science Indicators (ESI)of Institute for Scientific

Information (ISI).In 2016, he assisted in the establishment of National Organization "Taiwan Bio-energy Technology Development Association, TBTDA", and serving as executive director to provide technical and professional suggestions to environmental and bio-energy industries in Taiwan. The purpose of TBTDA is to strengthen the link between government and industries, and enhance the legislation progress of Law. At the same time, he also teamed a scholarly group to promote the cooperation of industries and government for the carbon neutralityornet-zero emissions.

Mohamed Kouki
LS2N-Ecole Centrale de Nantes, 1 Rue de la Noë, 44300 Nantes-France

E-BABE-Coupling Mode Identification for Power Systems with High Penetration of Power Electronics

Abstract
The penetration of Power Park Modules (PPMs) in modern power systems has significantly increased by the growing demand for renewable energy sources. Consequently, inter-area modes that involve distant groups of dynamic devices, are no longer the majority of existing modes. New modes called "electrical modes" involving distant classical generators and PPMs are highlighted at high frequencies. This presentation will provide, a methodology which allows to identify the oscillatory modes (inter-area and electrical modes) of any modern power system, in particular power system with high penetration of power electronics. Furthermore, the modal analysis of RMS and EMT power system will be discussed. Finally, the full modal analysis of detailed large scale power system with high penetration of power park modules using the model order reduction will be presented.

Biography
Mohamed Kouki was born in Tunisia, in 1986. He received the M.Sc. degree in electronic engineering from the Faculty of Sciences of Tunis, Tunisia, in 2011, and the Ph.D. degree in electronics with straight honors from the Faculty of Sciences of Tunis, in 2014. He is currently a Research Engineer and Manager of POSYTYF project (H2020-POSYTYF) with Ecole Centrale de Nantes in Laboratoire des Sciences du Numériques de Nantes (LS2N), France. His main research interests include model order reduction and modal-analysis of power systems. He has published more than 15 papers in reputed conferences and journals.
Photograph

Juan M Gers
Gonzaga University, USA

Protection of Power Systems with Distributed Generation Considering International Standards Review

Abstract
Since the electrical networks changed with the incorporation of renewable generation, some protection schemes have been affected as it will be illustrated in this paper. To date, different standards are used as a reference on the penetration of renewable sources on Distribution Networks. A summary of some associated standards is given in this work and how are they used to support the protection systems design. Finally, some study cases are described to illustrate the protections performance due to the renewable generation.

Biography
Juan M Gers obtained his undergraduate degree as Electrical Engineer from the Universidad del Valle in Cali, Colombia in 1977. In 1981 he finished a Master's Degree in Power Systems Studies at the University of Salford in England, and his doctorate with research in distribution systems and automatization at the University of Strathclyde in Scotland in 1998.Dr. Gers founded GERS in 1981, an electrical engineering consultant group with operations in the USA, Colombia, Mexico, and Chile. He has also served as a professor at Florida International University, Gonzaga, Penn State, and University of Valle, and held the position of Viceminister of Mines and Energy of Colombia in 2002. He is the author of the book "Distribution System Analysis and Automation" (2nd Ed) and co-author of the book "Protection of Electricity Distribution Networks" (4th Ed) published by the Institution of Engineering and Technology (IET) in 2020 and 2021 respectively. Dr. Gers is a Chartered Engineer of the IET and IEEE Senior Member.

Manfred Doepp
Liebig University, Germany

Energy Elevation of the Population as a Way to Reduce External Energy Consumption

Abstract
You can approach the energy problem from two sides: a) improve production (make it sustainable), b) reduce consumption. Ultimately it is always people who decide on energy consumption. And they decide according to their own energy situation. If this is endogenously optimal, less external energy is consumed. Environmental energy deficits (ATP and/or Chi) lead to increased consumption. To compensate for this deficit, biochemically effective Adaptogens and Antioxidants can be used. Another influencing factor is technical electrosmog (e.g. 5G). Here it is a matter of protecting oneself. Means and methods are shown.

Biography
Born in Bad Berleburg/Germany. Medical studies in Munich and Giessen, exams and doctoratein 1971. Scientific assistant at the clinical centre of the Justus Liebig Universityat Giessenuntil 1978. Senior physician for nuclear medicine at the clinical centre in Hanau until 1985. Founder of the “International Institute for Experiential Medicine, www.iifeh.de; Founder of the “Diagnostic Centre for Mineral Analysis and Spectroscopy DCMS. From 2011 to 2018 Head Physician of the Quantisana Health Centre for Holistic Diagnostics and Therapy in CH9404 Rorschacherberg. Since 2018 Head of the HolisticCenter in CH9030 Abtwil. Many oral and written publications in the field of complementary and energymedicine. Manyvideos on Youtube, Google and complementary portals. Reviewer of international journals. Co-founder and Deputy Presidentof DGEIM (German Society forEnergetic and Information Medicine, Stuttgart www.dgeim.de).

B. Marinescu
Ecole Centrale Nantes, France

Control architectures for renewable energy generators ofa Dynamic Virtual Power Plant

Abstract
The concept of Virtual Power Plant (VPP) has arisen over a decade ago from the relatively low competitiveness of the back then emerging non-dispatchableRenewable Energy Sources (RES). A set of smaller generators imitates the behavior of large synchronous generators. So far, static aspects such as generation or slow dynamics have been of interest, as it is the case for the zonal secondary frequency control scheme in Spain, which can be viewed as a VPP. However, considering dynamic aspects is of high importance, especially to further increase the current penetration level of RES. For that, we have proposed a new concept called Dynamic VPP (DVPP) which fully integrates the dynamic aspects at all levels: locally (for each RES generator), globally (for grid ancillary services and interaction with other close-by elements of the grid) and economically (for internal optimal dispatch and participation in electricity markets). A DVPP is a set of dispatchable and non-dispatchable RES along with a set of common control and operation procedures.

We propose a top-down set of control structures and synthesis methodologies to deal in a coordinated way to all aspects of operation of the DVPP. This means several aspects:

Coordination of the control at all time scales of the DVPP: from very fast dynamics of the power converters which connect RES generators to the grid (time constants of few milliseconds) to internal DVPP redispatching to cope with volatility of natural resources (sun and wind) (few seconds) and DVPP participation to secondary (voltage & frequency) controls and power & energy markets (few minutes/hours).

Coordination of controls among space distributed actuators which are the DVPP RES generators
Solutions for centralized vs decentralized control synthesis and implementation as a trade-off between performances and resilience (no need of reconfiguration of controls in case of failure of one/some DVPP generators, plug-and-play facilities,…)

Modeling & simulation challenges for mixed dynamics systems (very fast dynamics of power electronics of RES & slower dynamics of classic electromechanical generators)
Stability quantification and assessment challenges both for analysis and control needs for highly stiff DVPP dynamics

The DVPP concept will be presented along with centralized and decentralized control approaches developed on that purpose.

This new DVPP concept is now under development in the H2020 POSYTYF project (https://posytyf-h2020.eu/).

Biography
Bogdan Marinescu was born in 1969 in Bucharest, Romania. He received the Engineering degree from the Polytechnical Institute of Bucharest in 1992, the PhD from Université Paris Sud-Orsay, France in 1997 and the “Habilitation à diriger des recherches” from EcoleNormaleSupérieure de Cachan, France in 2010. He is currently a Professor in Ecole Centrale Nantes and LS2N laboratory

where he isthe Head of the chair “Analysis and control of power grids” - http://chairerte.ec-nantes.fr/home/ - (2014-2024) and the Coordinator of the POSYTYF H2020 RIA project - https://posytyf-h2020.eu/ - (2020-2023) and DREAM Erasmus Mundus Master - https://master-dream.ec-nantes.fr/ - (2021-2027). In the first part of his carrier, he was active in R&D divisions of industry (EDF and RTE) and as a part-time professor (especially from 2006 to 2012 in Ecole Normale Supérieure de Cachan). His main fields of interest are the theory and applications of linear systems, robust control and power systems engineering.

Poster Presentation

I. Arachchi[1]

I. Arachchi[1*] and M. Bentley[2]

[1,2]Department of Power Engineering, Keyano College, Clearwater Campus, 8115 Franklin Ave, Fort McMurray, Alberta, T9H 2H7, Canada.

The Prototype Unit with Smart Locks for the Digitization of Lock Out and Tag Out (LOTO) in Hazardous Energy Isolation.

Abstract
The Lock Out and Tag out (LOTO) procedure is the method of energy isolation used in power and energy engineering services. Currently, Rockwell Automation providessoftware to convert traditional LOTO into a digital format. The products supplied by Nokē Smart and thee Gee Touch integrate digital LOTO with the use of Bluetooth padlocks. The short fall of these locks includes operating temperatures of, short range, and nearly 3 years of battery life.

According to the current experimental data, the proposed prototype smart locks successfully communicate with the primary receiver below with a battery life of nearly 8 years. The smart padlocks have a unique identification that is used for isolation and is integrated with a 433MHz signal transmitter. Current sensor units are taken from Tire Pressure Monitoring systems (TPMS) modules. The handheld device includes a Raspberry Pi 4 Model B board with a camera module, ID and fingerprint scanner, display, and a rechargeable 5V Lithium-ion cell. A single padlock key is secured inside the module and will be accessible after the activation of the scanner (ID or fingerprint). A picture of the actual location, including the installed padlock, will be recorded using the integrated intrinsically safe camera under ambient light conditions. This picture will be accessible via a digital Piping & Instrumentation Diagram (P&ID). Python is used as the primary programming language in this module.

Once the installation of smart padlocks is complete, the handheld module will generate a completed LOTO sheet with digital P&ID. This will overcome the practical difficulties of verifying and continuous/ remote monitoring of LOTO isolation points in the plant. The centralized digital audit trail will boost plant annual productivity by reducing human error.

Further development includes Anti-tampering trigger alarms and jump-start features to the smart padlocks.

Keywords
LOTO, Energy Isolations, Smart Padlocks, Remote Monitoring

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Biography

Indika Arachchi is a teaching fellow at department of Power/Process Operations at Clearwater Campus, Keyano College, Alberta, Canada since 2020. He also conducts teaching and research at Oil Sands Power and Process Engineering laboratory in the same institute. Indika holds a BSc, MSc in Medical Physics and a PhD in soft X-ray Physics from Kings College London, University of London, United Kingdom. Further, he is a research fellow at Stephenson Cardiac Imaging Centre in University of Calgary, Canada. Subsequently, Indika contributed his expertise & knowledge in process operations in Suncor Energy petroleum refinery, pioneers in production of synthetic crude from oil sands in Northern Alberta, Canada. His current research focus is digitization of hazarder's energy isolation/Lock Out and Tag Out (LOTO) in oil and gas industries. Indika holds fellowship of Higher Education Academy, UK. He has published several research papers in reputed conferences and journals.

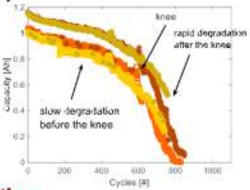
Diagnostic Tools to Assess Lithium-ion Battery Health

Muhammad Aadil Khan (maadilk@stanford.edu), Simona Onori (sonori@stanford.edu)
Department of Energy Science & Engineering
Stanford | Doerr School of Sustainability
Stanford Energy Control Lab
https://onorilab.stanford.edu/

Motivation

Transition to batteries, especially in electric vehicles (EVs), is the leading solution to mitigate the harmful effects of climate change. As number of EVs sold per year increases, first wave of retired batteries is also expected soon; reuse or "second-use" of these batteries, for stationary application like the grid, is being considered as a sustainable solution to achieve grid decarbonization and build a circular economy. The capacity knee[1] is the transition point between slow, linear degradation (before the knee) and fast, non-linear degradation (after the knee). Concurrent to the knee point, elbow[2] in impedance is also observed. The knee/elbow point is also considered as the end-of-life (EOL) point after which rapid, irreversible degradation takes over inside the battery.

It is important to detect the elbow/knee and to know how far away the battery is from its EOL. This is possible through online calculation and monitoring of battery impedance and correlating it with the battery knee to ensure that they battery is healthy during its operation.



Research Objective

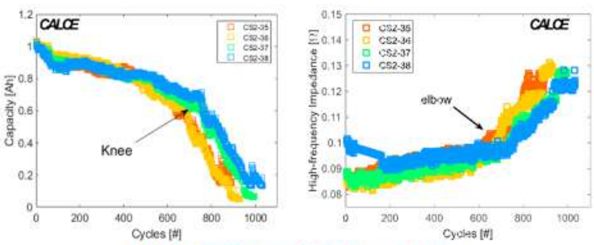
To develop an algorithm that can use the information provided by regular sensors (current and voltage) on battery management system (BMS) to predict the onset of the impedance elbow, and hence, the capacity knee, online to inform the user about the state of health (SOH) of the battery. Our algorithm:

- calculates impedance online from any duty cycle (driving/grid profile)
- is chemistry-agnostic
- is cost effective, scalable, and deployable as it does not require any additional sensing capabilities inside the BMS

Open-source Datasets

Two open-source datasets are analyzed:

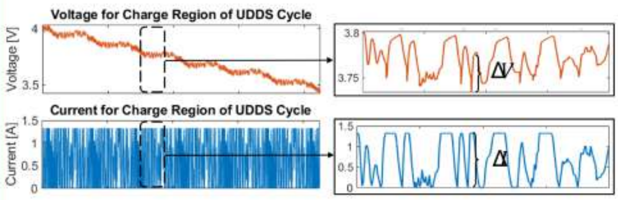
Parameters	Center for Advanced Life Cycle Engineering (CALCE) dataset[3]	Stanford Energy Control Lab (SECL) dataset[4]
Cell Chemistry	$LiCoO_2$	$LiNiMnCoO_2$
Form factor	Pouch	Cylindrical
Capacity Rating	1.1/1.35 Ah	4.85 Ah
Min/Max Voltage	2.7/4.2 V	2.5/4.2 V
Cycling Protocol	CCCV Charge/CC Discharge	CCCV Charge/CC-UDDS Discharge
C-rate(s)	C/2, 1C, 3C	C/4, C/2, 1C, 3C



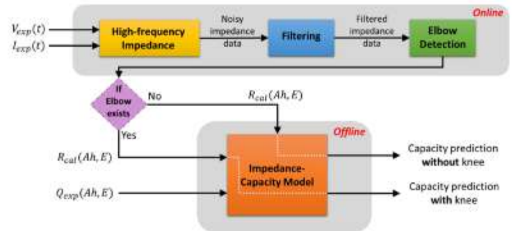
High-frequency (HF) Impedance

- As battery ages, HF impedance is expected to increase resulting in loss of battery capacity which decreases
- We calculate impedance from Urban Dynamometer Driving Schedule (UDDS) in the SECL dataset to show that it can be calculated online as well

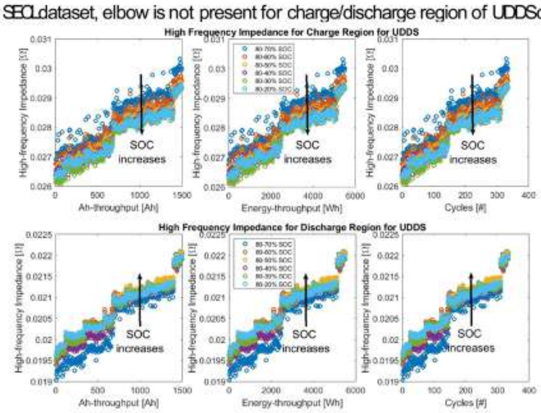
$$R_{HF,j} = abs\left(\frac{\Delta V}{\Delta I}\right), j \in \{ch, dis\}$$



Algorithm Block Diagram



- For SECL dataset, elbow is not present for charge/discharge region of UDDS cycle

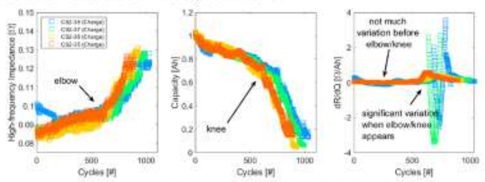


Elbow Detection

Numerical gradient of HF impedance with capacity is monitored to detect the presence of elbow

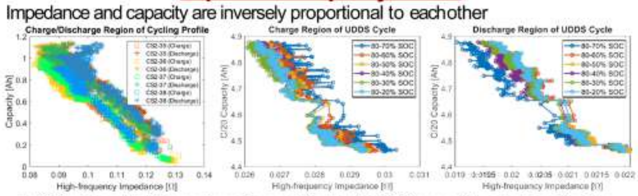
$$\frac{dR}{dQ} = \frac{R_{HF,j,i+1} - R_{HF,j,i}}{Q_{j,i+1} - Q_{j,i}} \left[\frac{\Omega}{Ah}\right], j \in \{ch, dis\}, i = 1,2,\ldots,n$$

Savitzky-Golay filter of order 3 is applied to impedance and capacity data to remove noise and make elbow/knee prominent



Impedance-Capacity Model

Impedance and capacity are inversely proportional to each other



- In SECL dataset, HF impedance is combined with C/20 capacity calculated in the lab
- In CALCE dataset, HF impedance is combined with capacity obtained from cycling

Future Work

Enhance the current architecture with machine learning framework and add more features to improve prediction capabilities

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Maria Solakidou[1, 2],

Maria Solakidou[1,2], Areti Zindrou[1], Szymon Smykala[3], Yiannis Deligiannakis[1]*

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[2]Laboratory of Biomimetic Catalysis and Hybrid Materials, Department of Chemistry, University of Ioannina, 45110, Ioannina, Greece
[3]Institute of Engineering Materials and Biomaterials, Silesian University of Technology, 18a Konarskiego St, 44-100 Gliwice, Poland

Dual Cocatalytic Nanohybrids [(Rutile) Tio_2/Au/(Rutile) Ruo_2] and [(Anatase)Tio_2/Au/(Rutile)Ruo_2]; Switch Between Strong Oxide Support Interaction and Heterojunction for Overall Water Splitting

Abstract
Photocatalytic hydrogen (H2) and oxygen (O2) generation using semiconducting materials is regarded as the most promising approach for solar energy conversion and the framework for future renewable energy supplies. Among various metal oxide semiconductors, TiO_2 has been extensively employed as a photocatalyst because to its comparatively high photocatalytic activity, stability into photochemical corrosion, low cost and nontoxicity. But it has various limitations, with the most important being the fast electron (e-)- hole (h+) recombination, and large band gap (3.2-3.0 eV), establishing a non – solar light semiconductor. Surface modification and bang gap engineering could be very important strategies for improving the overall photocatalytic activity from the TiO2. To this direction, numerous studies include the loading of noble metals, the ion doping, or a junction with another metal oxide. Heterojunction with another semiconductor (RuO_2, IrO_2, NiO_2), could be an another successful strategy. Among them Ruthenium Oxide (IV) RuO_2, which belongs to the family of the d-band transition-metal oxides with a rutile-like structure exhibits a wide range of characteristics. Its chemical stability, electrical (metallic) conductivity, and outstanding diffusion barrier properties make it an ideal diffusion barrier material. Consequently, a successful cocatalyst deposition technique onto TiO_2 must satisfy the following requirements: (1) high dispersion capacity onto the TiO_2 surface, (2) optimal interfacing of rutile/anatase ratio and (3) stable adsorption configurations of cocatalyst-catalyst through lattice matching. Some synthesis techniques have satisfied the three conditions, despite their disadvantages of being multistep, time-consuming, or meeting just a portion of the three criteria. Using Single Nozzle (SN) and Double Nozzle (DN) Flame Spray Pyrolysis (FSP) technology, we have synthesized with different loadings, dual cocatalysts [(R)TiO2/Au/(R)RuO2] and [(A)TiO2/Au/(R)RuO2], (where R=Rutile and A=Anatase) nanoparticles in a single step. As it proved from characterization techniques, TEM microscopy and EPR study the DN [TiO2/Au/RuO2] nanohybrids promotes the construction of Strong Oxide Support Interactions (SOSI).

Keywords
Water splitting; Hydrogen production; TiO2/Au/RuO2 heterojunction; Semiconductor;

Funding
This research was funded by the Hellenic Foundation for Research and Innovation (H.F.R.I) under the "First Call for H.F.R.I Research Projects to support Faculty members and Researchers and the

procurement of high-cost research equipment grant" (HFRI-FM17-1888)

Biography

Dr. Solakidou Maria is a post Ph.D. researcher at the Department of Physics, University of Ioannina, Greece. She received her Ph.D., relevant with synthesis of hybrid-nanomaterials for H2 production, at the Department of Chemistry, University of Ioannina, in 2020 and her master degree at the Department of Materials Science & Engineering, with title ''Chemistry and Technology of Materials''. She holds two Bachelor degrees at (1) Environmental Engineering (University of Patras, Polytechnical School, Greece, 2013) and (2) Chemistry (University of Ioannina, Department of Chemistry, Greece, 2022). This period she have enrolled to a second master degree program relevant with Medical Chemistry. As a post-doctoral researcher at Ioannina University, she is currently dedicated to the development of nanoheterojunctions for the photochemical splitting of water and the reduction of CO2. With a focus on the synthesis of nanomaterials and hybrid materials, she is also working towards improving the efficiency and sustainability of H2 production from C1 organic molecules. With a drive to make a positive impact in the world and push the boundaries of scientific discovery, she have published 15 papers (>337 citations, h-index=8, Google Scholar)-while 4 have been submitted-in prestigious journals and presented her research at 21 International and Panhellenic conferences. She has granted with one fellowship for her master («IKY FELLOWSHIPS OF EXCELLENCE FOR POSTGRADUATE STUDIES IN GREECE- SIEMENS PROGRAM» 2nd calling , 2014-2015) and with two for her Ph.D ((1) Bodossakis Foundation, 01/08-01/12/2016 and (2) ''Strengthening Human Resources Research Potential via Doctorate Research" (MIS-5000432), implemented by the State Scholarships Foundation (IKY), 2016-2019). Currently she is participating as a post-doc in 3 research programs; (1) HRFI:'' Development of Photocatalytic Engineered-Conduction-Band Nanoheterostructures for Artificial Photosynthesis, CO2 Reduction with H2O Oxidation'', (2020-2023), (2) ARISTEIA: ''Center for Research, Qualitative Analysis of Cultural Heritage Materials and Science Communication'' (2022-2023), (3) HRFI: '' Development of Hybrid NanoScaffolds for Continuous H2 Production by C1-Substrates', (2022-2025).

Virtual Presentations

Arijit Karati
National Sun Yat-sen University, Taiwan

Cyberattacks and Energy-efficient Cryptographic Solutions for Space Information Network

Abstract
As an extension of the terrestrial network, the Space Information Network (SIN) has taken intelligent communication to the next level in recent years, fostering an abundance of Internet of Things (IoT) commercial potential through continuous connectivity, massive capacity, high dependability, and broad coverage. Recently, the SIN has received more attention for active message forwarding than for dependable access to many services over a public channel. The primary purpose of SIN is to provide service accessible everywhere, at all times, especially in regions where cellular network deployment is challenging. However, inappropriate execution with significant access latency raises safety and privacy risks by providing hostile actors with a backdoor to attack a single target or the entire SIN system. For example, exposed links and increased signal delay in SIN make it challenging to develop a secure and quick roaming authentication. Due to inadequate security, network resources are abused in an unauthorized manner. This talk will discuss a variety of cyber threats and their possible energy-efficient cryptographic solutions.

Qiancheng Zhu
National & Local Joint Engineering Laboratory of New Energy Photoelectric Devices, College of Physics Science and Technology, Hebei University, Baoding, 071002 China

Achieving High-Capacity Cathode in Aqueous Zn Ion Batteries

Abstract
Employing low-cost and reliable electricity generated fromrenewable and clean energy sources is imperative for the sustainable development of human beings. To realize this goal, electrical energy storage (EES) is crucial to the reliability ofpower grid since renewable energy sources, such as wind, solar, tidal, and geothermal sources, are all inherently intermittentand spatially dispersed. Li-ion batteries are currently the mostcommonly used commercial EES devices. However, the scarcityof resources and the environmental impact related to the production of Li-ion batteries, as well as the safety issues during their use, severely hinder their widerdeployment. Rechargeable aqueous Zn-based batteries are highly desirable for future applications in large-scale energy storage since they are inexpensive and safe in comparison with lithium-ion batteries (LIBs). Specially, the high energy density of Zn batteries stands out in all types of aqueous batteries. However, acquiring much higher energy density that could be comparable to LIBs is still a big challenge for future development of Zn batteries. As widely reported, there are two typical energy storage mechanism in cathode materials, “conversion-type mechanism” and “insertion-extraction mechanism”. Here, from the intrinsic energy storage mechanism, we proposed some ideas to acquire high-capacity Zn cathode. For “conversion-type mechanism”, we believe the multi-electron conversion reaction could help to obtain high-capacity cathode, such as Cu, Mn and Co based cathodes etc. For “insertion-extraction mechanism”, ultrathin materials like V2O5▪xH2O with only 3-4 atomic layers in our work can achieve high-capacity Zn cathode.

Biography
Dr. Qiancheng Zhu received his Ph.D. Degree at Central China Normal University. He used to work at University of Houston as a visiting Ph.D. student in Professor Zhifeng Ren’s group. Now, he was employed by Hebei University as a school hired professor. His research interests in aqueous energy storage. He has published papers on international journals in his interest research area, such as Adv. Energy Mater., Adv. Funct. Mater., Sci. Bull., Chem. Eng. J., etc. He won “Yangtze-river students’ innovation award” of Hubei Province twice in 2015 and 2021. He is themember of Chinese Chemical Society and Chemical Industry and Engineering Society of China. He was invited to be Vebleo Fellow in 2022.He is also the referee of some international journals like Materials Today Physics etc.

Yang Han
University of Electronic Science and Technology of China, China

Modeling and Control of Power Electronic Converters for Renewable Energy Integration

Abstract
This presentation introduces the fundamental ideas of power electronic converter modeling and control, digital simulation, and experimental studies in the renewable energy systems and AC/DC microgrid. Recent advanced control methods for voltage source inverters (VSIs) and the hierarchical controlled islanded micro grid would be presented, including the mathematical modeling, controller synthesis, parameter selection and multi-time scale stability analysis, as well as the consensus-based control strategies for the micro grid and micro grid clusters. This topic would be an invaluable technical reference for practicing engineers and researchers working in the areas of renewable energy, power electronics, energy internet, and smart grid. This topic has been published in the recent book “Modeling and Control of Power Electronic Converters for Micro grid Applications” by Springer: https://www.springer.com/gp/book/9783030745127.

Biography
Yang Han (S’08-M’10-SM’17) received the Ph.D. degree in Electrical Engineering from Shanghai Jiaotong University (SJTU), Shanghai, China, in 2010. In 2010, he joined the University of Electronic Science and Technology of China (UESTC), Chengdu, China, where he has been an Associate Professor in 2013 and Full professor in 2021. From March 2014 to March 2015, he was a Visiting Scholar with the Department of Energy Technology, Aalborg University, and Aalborg, Denmark. He is currently with the School of Mechanical and Electrical Engineering, UESTC. His research interests include the ac/dc micro grids, active distribution networks, power quality, and grid-connected converters for renewable energy systems, active power filters, multilevel converters, and static synchronous compensators (STATCOMs).

Dr. Han has received several national and provincial projects, and more than 30 industrial projects in the area of power electronics, smart grid, micro grid, and power quality analysis and compensation. He holds more than 40 issued and pending patents. Dr. Han was listed as “World’s Top 2% Scientist 2022” by Stanford University in 2022, and the recipient of the Young Scientist Award in CPESE 2021, the Provincial Science and Technology Award in 2020 and 2022, Science and Technology Award from Sichuan Electric Power Company in 2019, Academic Talent Award by UESTC, in 2017, Baekhyun Award by the Korean Institute of Power Electronics, in 2016. He has published a book “Modeling and Control of Power Electronic Converters for Microgrid Applications”, ISBN: 978-3-030-74512-7, Springer. He served as an Associate Editor of Journal of Power Electronics and IEEE ACCESS(2019-2020).

Muhammad Noaman Zahid
Hunan University of Humanities, Science and Technology, China

An Efficient Power Amplifier Design with Improved Efficiency for RFID Wireless Applications

Abstract
In Radio Frequency (RF) communication, a Power Amplifier (PA) is used to amplify the signal at the required power level with less utilization of Direct Current (DC) power. The main characteristic of class-E PA is sturdy nonlinearity due to the switching mode action. In this study, a modified design of class-E PA with balanced Metal Oxide Semiconductor Field Effect Transistors (MOSFETs) and high output power for Electronic Article Surveillance (EAS) Radio Frequency Identification (RFID) application is presented. MOSFETs are adjusted to have high output performance of about 80% for RFID-based EAS system. A matching network is also proposed for accurate matching because there are differences in the behavior between RF waves and low frequency waves. The design of a matching network is a tradeoff among the complexity, adjustability, implementation, and bandwidth for the required output power and frequency. The implemented PA is capable of providing 44.8 dBm output power with Power-Added Efficiency (PAE) of 78.5% at 7.7 MHz to 8.7 MHz.

Biography
Muhammad Noaman Zahid received his Ph.D. degree with the honor of excellent student from Beijing Institute of Technology (BIT), China, and M.S. degree from Capital University of Science & Technology (CUST), Pakistan, in 2021 and 2015, respectively. He is currently a Technical Expert (TE) with the school of information, Hunan University of Humanities, Science and Technology, located in the southern part of China. Form 2019 he published more than 30 research papers in well peer reviewed academic journals and conferences (SCI and EI) at home and abroad. His primary area of expertise is RF circuit design and fabrication for wireless and RFID applications, and his secondary research interest includes applied electromagnetics, optical communication, and cooperative-intelligent transportation systems.

Arijit Ganguli
Ahmedabad University, India

Experimental Measurements and CFD Simulations for Evaluation of Lift Force of Single Bubbles in Sub-Cooled Pool Boiling Systems

Abstract

Lift force occurring in a subcooled pool boiling system with water inside has been studied for a specific Rayleigh number (Ra) range (8x1012< Ra < 2x1013). Experimental investigation has been done with High Speed Camera while two phase CFD simulations have been performed using Volume of Fluid (VOF) method. The predicted lift coefficients (CL) for single bubbles rising in water subjected to turbulent natural convection matched well with the experimental measurements using high speed photography. The data obtained is different from the ones of bubbles generated by single sparger in air-water systems. The data will be helpful for two phase Eulerian-Eulerian models for solving different fundamental problems in subcooled boiling systems

Biography

Dr. Arijit Ganguli is an Assistant Professor in School of Engineering and Applied Sciences (SEAS) at Ahmedabad University. He received his PhD degree from the Institute of Chemical Technology, Mumbai in 2009. Post PhD, he has two year Post Doc Experience in the Germany at the University of Paderborn and Paul Scherrer Institute in Switzerland.He has around 7 years industrial experience post his Post Doc after which he joined academia engaging in teaching and research. His research interests include CFD of multiphase flows, microfluidics, optimization of process equipment's using CFD and technology development. His teaching includes courses like Fluid Mechanics, Heat Transfer, Mass Transfer, Transport Phenomena, Process Calculations and Computational Fluid Dynamics.

Z. Zhang*
[1]School of Data Science, City University of Hong Kong, Hong Kong SAR, China.

Machine Vision for Auto-Plotting Wind Energy System Performance Curves

Abstract
Performance curve is an important measure for assessing conditions and efficiencies of systems. Yet, estimating high quality real performance curves for systems via traditional statistical aspect methods involve cumbersome data pre-processing and repeated model fitting. This talk introduces a data-synthesis-informed-training U-net (DITU-net) based method to realize the machine vision assisted automation of the system performance curve modeling without data pre-processing, which is the first time in the literature. The proposed DITU-net only needs to be trained once and does not require any data preprocessing in applications. We have tested the proposed DITU-net on a famous problem in the renewable energy system application, the power curve modeling of wind turbines. Numerical experiments based on 76 WTs are conducted to validate the superiority of the proposed method via benchmarking against classical WPC modeling methods.

Keywords
Wind Energy, Data Science, Machine Vision, Deep Learning, Performance Curve, Data-driven Modeling

References
L. Yang, L. Wang, Z. Zhang*, "Generative Wind Power Curve Modeling via Machine Vision: A Deep Convolutional Network Method with Data-Synthesis-Informed-Training," IEEE Transactions on Power Systems, 2022, in press.

Biography
Dr. Zijun Zhang received his B.Eng. degree in Systems Engineering and Engineering Management from the Chinese University of Hong Kong, Hong Kong, in 2008, and the M.S. and Ph.D. degrees in Industrial Engineering from the University of Iowa, Iowa City, USA, in 2009 and 2012, respectively.

His is currently an Associate Professor in the School of Data Science and Associate Director of Centre for Systems Informatics Engineering at City University of Hong Kong, Hong Kong, China. His research focuses on machine learning and computational intelligence methods as well as their applications in the renewable energy, facility energy management, rail transportation systems, and manufacturing processes. He is a senior member of IEEE. He is currently serving as an Associate Editor for IEEE Transactions on Sustainable Energy, IEEE Power Engineering Letters, and Journal of Intelligent Manufacturing, as well as the advisory board member of Patterns: Cell Press.

Edyta Wrzesińska-Jędrusiak

Institute of Technology and Life Sciences – National Research Institute, Falenty , Al. Hrabska 3, 05-090 Raszyn, Poland

Circular Economy in the Management of Waste from Leather Processing - Shavings and Tannery Waste Water.

Abstract:
The tanning industry generates significant amounts of solid waste and post-production effluents, which should be destined for further treatment or management according to circular economy principles. These wastes are generated at different stages of production. A comprehensive solution to the problem of waste disposal is very important from an economic and environmental point of view. As part of the MIZDRA 2.0 project, co-financed by the European Union and implemented as part of the National Centre for Research and Development, a processing technology has been developed to manage shavings and tannery wastewater according to circular economy and waste handling. A technological system for the further processing of production residues has been designed. A feasibility study related to the energy treatment of production residues through anaerobic digestion, purification of the liquid fraction and briquetting of the solid fraction. In the liquid fraction pretreatment system, the feasibility of using membrane processes with ceramic membranes to pretreat the wastewater generated in the leather tanning process and reduce at least 30% COD (chemical oxygen demand). Preliminary tests confirmed more than 30%. of a COD reduction. The briquetting installation with a system allowed the liquid application of additives at different moisture content has been used. The research is aimed at the possibility of producing solid fuel in the form of briquettes with the addition of post-production residues from leather production. Triticale straw in the form of chopped straw and flesh shavings were used for briquette production.

Biography

Edyta Wrzesińska-Jędrusiak - R&D manager and expert in national and international projects with several years of scientific experience. Doctor of Agricultural Sciences. She is a graduate of the Faculty of Land Reclamation and Environmental Engineering, with a specialisation in Environmental Engineering at the Poznań University of Life Sciences. She works at the Department of Technology in the Institute of Technology and Life Sciences National Research Institute as an assistant professor. He carries out activities related to scientific research and development works. He is a co-author of scientific publications, conference presentations and posters related to the subject of farm waste management and industrial production. She participates in conferences and consultations related to environmental issues, agricultural intensification and renewable energy sources.

Elisa Moretti

Department of Molecular Sciences and Nanosystems, Ca' Foscari University of Venice, Via Torino 155, 30172 Venezia Mestre, Italy

Design, Synthesis and Energy-Related Applications of Multifunctional Inorganic Nanostructures

Abstract

Nowadays, one of the main technological challenges that we are facing is the ability to provide a sustainable supply of clean energy and, among all renewable sources, solar energy displays the greatest potential. Recently, the development of novel synthetic strategies has led to the preparation of nanostructured materials displaying unique properties compared to the bulk counterpart systems, with controlled and tunable morphologies able to enhance the activity and selectivity of a heterogenous process.

This talk will focus on the importance of tuning the morphological features of a catalyst as a strategy to improve its photoactivity, focusing on how rationally designing inorganic materials at the nanoscale can lead to shapes and structures suitable to enhance the performance of industrially and environmentally important processes. The talk will discuss some energy and environmental applications that can be addressed by multi-component systems synthesized via the bottom–up approach, highlighting their structure-reactivity relationship. Photocatalytic H2 production and purification, and drugs degradation will be presented as successful cases history.

Biography

Elisa Moretti is Associate Professor of Inorganic Chemistry at the Department of Molecular Sciences and Nanosystems, Ca' Foscari University of Venice (Italy). After receiving a PhD Degree in Chemistry at the Ca' Foscari University, she spent several research periods at the University of Malaga (Spain) and the Institute of Materials Science CSIC-University of Seville (Spain) for a post-doctoral experience. She is leading a multidisciplinary group focusing on the development of advanced 0-3D nanostructured inorganic materials for energy and environmental applications (e.g. photocatalysis and electrocatalysis for H2 production, drugs photodegradation for water remediation, water desalination).

Pierluigi Siano
University of Salerno, Italy

Smart Energy Commnunites for the Energy Transition

Abstract
Facilitated by experimentations, such as the ones of energy communities, new actors are emerging with the role of aggregators and other intermediaries acting as service providers. Furthermore, looking at the multiplicity of actors' roles deriving from the energy transition, the shift underway in energy access is resulting in electricity consumers becoming prosumers, i.e., consumers who are also producers of renewable energy and who use that energy more intelligently and efficiently. In other words, citizens are starting to become less dependent on energy companies. Block chain technology can be used to enable Peer-to-Peer (P2P) transactions in a decentralized way, without the need for a central authority. Additionally, the design of new distributed architectures and methods able to cope with the issue of scalability in smart grids and microgrids consisting of several distributed energy resources is fundamental.

A novel scalable and privacy-preserving distributed parallel optimization that allows the participation of large-scale aggregation of prosumers with residential PV-battery systems in the market for the ancillary service (ASM) is proposed. To consider both reserve capacity and reserve energy, day-ahead and real-time stages in the ASM are considered. The proposed LP-based optimization can be easily coded up and implemented on microcontrollers and connected to a designed Internet of Things (IoT) based architecture. Both day-ahead and real-time proposed optimization methods, by allocating the computational effort among local resources, are highly scalable and fulfill the privacy of prosumers.

Biography
Pierluigi Siano (M'09–SM'14) received the M.Sc. degree in electronic engineering and the Ph.D. degree in information and electrical engineering from the University of Salerno, Salerno, Italy, in 2001 and 2006, respectively. He is a Professor and Scientific Director of the Smart Grids and Smart Cities Laboratory with the Department of Management & Innovation Systems, University of Salerno. Since 2021 he has been a Distinguished Visiting Professor in the Department of Electrical & Electronic Engineering Science, University of Johannesburg. His research activities are centered on demand response, energy management, the integration of distributed energy resources in smart grids, electricity markets, and planning and management of power systems. In these research fields, he has co-authored more than 370 articles published in international journals that received in Scopus more than 13500 citations with an H-index equal to 57. In 2019, 2020, and 2021 he has been awarded as Highly cited Researcher in Engineering by Web of Science Group. He has been the Chair of the IES TC on Smart Grids. He is Editor for the Power & Energy Society Section of IEEE Access, IEEE TRANSACTIONS ON POWER SYSTEMS, IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, IEEE SYSTEMS.

Francesco Grimaccia
Polytechnic University of Milan, Italy

Drawing the Future Cities: Digital Energy, Sustainable Mobility and Urban Environments

Abstract

Recent urban and population growth require to design future urban areas to face the impelling challenges of climate change, sustainable buildings and people mobility with novel approaches able to take advantages of technology advancements and the new digital revolution paradigm. City planners and policy makers strive with global major concerns related to the context of recent crisis, which risks of compromising clean energy development supported by an in progress and pervasive digital transformation. This speech discusses the opportunities offered by ICT technologies and infrastructures in the energy sector to help cities moving from the old reactive and centric approach to conceive more sustainable use of energy and environmental resources in the main fields of urban needs and activities.

Debora Sarno
Parthenope University of Naples, Italy

The Role of Systems View for Assessing Energy Transitions

Abstract
Energy transitions (ETs) can solve some societal problems but must transform societies. Accordingly, some systemic frameworks have been used to assess ETs. However, most of them miss a value co-creation orientation, the focus on actors' researched benefits and enabled service exchange, and the consideration of needed de/re-institutionalization practices. Analyzing those elements could support policymaking to prevent socioeconomic shocks and loss of opportunities and unfold possible ET challenges against ET viability and sustainability. For these reasons, Service-dominant logic (S-D logic) is presented as an integrative framework to assess ETs. Its potentialities are illustratedthrough the analysis of some challenges of the current Italian ET.

Biography
Graduated in Management Engineering from the University of Salerno (Italy), she earned a PhD in Engineering and Economics of Innovation. She has been an adjunct professor and a lecturer in Service Marketing, Project Management, and Operations Management for several Italian and foreign Universities and highly trained courses for companies. She is an Associate professor of Management at the University of Naples Parthenope (Italy).She is also a Project Management Professional (PMP by PMI, USA) and she has supervised several research and start up projects. She has been the co-founder of two academic spin-offs. Her scientific interests aresystems theories and their applications to marketing and management, particularly in the fields of healthcare and energy.

Wenlong Ming
Cardiff University, UK

Topology Design and Control of Medium-Voltage DC Converters in Electricity Distribution Networks

Abstract
Medium voltage DC (MVDC) technology is becoming a more and more attractive solution forelectricity distribution networks due to its high power transfer capability, excellent controllability and operational flexibility. To date, a few practical MVDC links have been built across the world. Thefirst MVDC demonstration project in theEurope, i.e., Angle-DC project in the UK, was launched in 2017. Itconverts a conventional 33 kV AC circuit to smart and flexible27 kV DC operation between the Anglesey and North Wales.As theacademic partner of the Angle-DC project,Cardiff University has been focusing on design and control of power electronics converters for MVDC applications.

This presentation will firstlyfocus on the heart of MVDC converters, i.e.,converter topology design at different DC voltage levels. A systematic selection approachwill be presented in which the reliability, redundancy, efficiency and economic feasibility factors of different convertertopologieswill be systematically evaluated and compared. Due to their cost advantage, cascaded 3-level neutral-point-clamped (C3L-NPC) convertersare selected for further study.After that, control ofthe C3L-NPC converters will beanalysed with a focus on addressing DC volage imbalance across submodules. The fundamental reason of the DC voltage imbalance will be analysed in detail. A balancing control method will be presented, which includes a PI-based method with communication and communication-less droop-based methodupon loss of communication.Finally, a laboratory-scale MVDC testbed will be presented, which is down scaled from real converters used in the Angle-DC project. The testbed is used as a platform to experimentally validate the presented DC voltage balancing control strategy.

Biography
Wenlong Ming received the B.Eng. and M.Eng. Degrees in Automation from Shandong University, Jinan, China, in 2007 and 2010, respectively. He received the Ph.D. degree in Automatic Control and Systems Engineering from the University of Sheffield, Sheffield, U.K., in 2015. He is the winner of the prestigious IET Control & Automation Doctoral Dissertation Prize in 2017. He has been a Senior Lecturer of Power Electronics at Cardiff University, U.K., since August 2020 and a Senior Research Fellow funded by Compound Semiconductor Applications (CSA) Catapult, U.K., for 5 years since April 2020.
He was with the Centre for Power Electronics Systems (CPES), Virginia Tech, Blacksburg, USA in 2012 as an academic visiting scholar. He has (co-)authored more than 70 papers published in leading journals or refereed IEEE conferences. His research interests focus on packaging, characterisation, modelling and applications of wide-bandgap power electronics.

Prof. Pedro Gomez-Romero
NEO-Energy Group Leader at ICN2 (CSIC-BIST), Cerdanyola (Barcelona), SPAIN

Energy Storage, the Missing Piece

Abstract
We are in the middle of a no-return transition from fossil fuels to a sustainable energy model. The public tends to associate the latter to the deployment of renewable energies (REs). And sometimes policy makers also do. But a truly sustainable model is much more complex than that, even if we limit our discussion to electrical energy. Indeed, if we want electricity which is 100% renewable, REs are NOT enough to provide it. This apparent paradox is solved when we consider the need to compensate for the intrinsic variability of REs. Then, energy storage appears as an absolutely necessary piece of our energy puzzle which seems to have been neglected so far. This plenary conference will analyze the urgent need to implement energy storage as an essential part of the sustainable energy transition, will discuss the wide variety of technologies available, the many different timescales that need to be addressed, the matching between storage technologies and final applications and will finally present the need for novel R+D on novel materials, devices and systems co-designed by storage and final-application engineers.

Biography
Prof. Pedro Gómez-Romero (FRSC). CSIC Full Professor. NEO-Energy Group Leader (Novel Energy-Oriented Materials Lab) at ICN2, Barcelona, Spain PhD in Chemistry (with distinction) Georgetown University (USA) 1987. CSIC researcher at ICMAB from 1990 to 2007. Sabbatical year as a NATO Senior Research Fellow at the National Renewable Energy Laboratory (USA) in 1998-99. In 2007 he moved to CIN2, then ICN2 since 2013, as group leader of the Novel Energy-Oriented Materials (NEO-Energy) Group, heading up projects on materials and devices for energy storage and conversion, with emphasis on batteries, supercapacitors and hybrid devices. Author of more than 200 publications and 6 patents (> 15000 citations, H index 61), prof. Gomez-Romero has played a seminal role in developing energy storage research in the area of Barcelona (Spain) and pioneered the use of polyoxometalates as energy storing materials at an international level. Fellow of the Royal Society of Chemistry since 2014, CIDETEC Award to research on electrochemistry in 2017 (for work developed during 2013-16), cofounder of the spin-off Napptilus Battery Labs, prof. Gomez-Romero is very active in the social communication of science and has authored four award-wining popular science books, as well as two technical books (Functional Hybrid Materials, Wiley-VCH, 2004) (Metal Oxides in Supercapacitors, Elsevier, 2017).

Bahn Kitmo
Department of Renewable Energy, National Advanced School of Engineering of University of Maroua, Maroua, Cameroon

Smart Grids: Challenges and Perspectives

Abstract

Renewable Energy Systems (RES) offer the advantages of having green cities (GC) in the current context where it is necessary to reduce as much as possible the greenhouse gases such as CO2 that can come from non-renewable energy sources (NRES). Unfortunately, the shaping of their electrical power generation is facing huge difficulties, among which, harmonic distortions and frequency synchronism losses in multi-source systems (MSS). In this work, an algorithm called athletic-based PSO(ABPSO) is developed for power factor correction and allocation size determination of distributed generation(DG) connected to radial distribution electrical Grids(RDEG). This model defines the constraints to improve the voltage profile. The calculation of the harmonic distortion rate as well as the test of the obtained results on the IEEE 33-bus and IEEE 69-bus standards shows the efficiency of the proposed algorithm. The results obtained are compared to those implemented in the Homer Pro software. The reduction of the CO2 rate and the production cost of the distributed generations of type-I DG, type-II DG, type-III DG, and type-IV DG demonstrates a more accurate performance and the possibility to apply this model in smart grids.

Keywords

Athletic-Based PSO; Radial Distribution; Harmonic; Distributed Generation; Renewable Energy.

Biography

Bahn Kitmo is a teacher-researcher at the National Polytechnic School of Maroua (ENSPM). He has two research areas: Smart Grids and embedded systems. Currently, he is working on the optimization of multi-source power plants for Smart Grids using artificial intelligence. He developed several models for the prediction of energy consumption in stand Alone and Grid-connected systems. This aspect of energy control is focused focus on the reduction of total harmonics of distortion (THD) and on the design of multicellular active filters dedicated to high voltage systems. Since 2021, he is working on the optimization of North Cameroon's interconnected electrical Grids (NCIEG).

Siliang Yang
Leeds Beckett University, UK

A Study on How Moisture Loads from Hydrogen Gas Combustion may Affect Ventilation Rates in Kitchens within the Existing English Social Housing Stock

Abstract
Hydrogen is a clean fuel, which can be used in fuel cells to generate electricity, power and heat. This energy source can also benefit households in response to their daily energy demand such as cooking. However, hydrogen will turn into water to increase the moisture content, which might cause damp resulting in problems like poor indoor air quality. This study therefore explores how a hydrogen gas supply to homes may influence kitchen ventilation and air flow rates within the English social housing sector. A notional estimation from a commissioned study into the feasibility of a UK gas grid conversion was analysed against a sample range of environmental data including the application of current standards. Moreover, the study theoretically examined how the notional increased moisture load due to hydrogen combustion for cooking and seasonal changes may affect the required volume of supply air. The supply air volume required was found to increase with the increase in moisture load until supply air temperature equals the temperature of the indoor environment. Basically, the study revealed that there will be a marginal increase in moisture load as a direct result of the hydrogen gas combustion process, but in practicethis yield may increase further due to the different calorific values of hydrogen and natural gas; this combined increase would have the potential to exceed existing Relative Humidity standards for kitchens areas in homes. Overall, this study seeks to further contribute towards the feasibility of a UK gas decarbonisation strategy.

Biography
Dr. Siliang Yang is a Lecturer in Building Services Engineering in the School of Built Environment, Engineering and Computing at Leeds Beckett University in the UK. Prior to that, he was a Sessional Academic and Research Assistant at the University of New South Wales, Australia. Dr. Yang completed his PhD in Built Environment in the School of Built Environment at the University of New South Wales, Australia, in 2020. He received a MEng (honours) in Building Services Engineering from Northumbria University, UK, in 2013.
He has published his important research outputs in reputable international journals, conferences, book chapters and government reports, and has been an Associate Editor for International Journal of Solar Thermal Vacuum Engineering and reviewer of the prestigious journals such as Energy and Buildings, Energy, Building Engineering, Sustainable Energy Technologies and Assessments, Building and Environment, Energy Conversion and Management, Energies, and Sustainability, etc. Before joining academia, Dr. Yang was a passionate engineer with years of experience worldwide in building and construction industry.
He most recently served as a Sustainability Engineer at Thermal Environmental Engineering in Australia. Before that, he was a Building Physics Engineer at Arup, China, and earlier in Singapore, he worked for ZEB-Technology Pte Ltd as an Environmentally Sustainable Design (ESD) Consultant. Over the last 12 years, Dr. Yang has established vocational skills and knowledge of design of buildings and in-depth study of low carbon and renewable energy systems in both industrial and academic environments. He has been working on projects of various sizes in terms of sustainability, low carbon building design in Australia, Singapore, Malaysia, Middle East and China, etc. Dr. Yang's research interests are focused on building performance, sustainability, and low carbon buildings and

systems.
His current research activities include:
- Low/net zero carbon buildings
- Sustainable and smart architectures
- High-efficient HVAC systems
- Building-integrated renewable

D.Sellami*1

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Study of a Solar energyfor Possible Use in Heating an Agricultural Greenhouse Destined for Growing Tomatoes in Tunisia

Abstract

Based on the fact that several regions worldwide and even in Tunisia are affected by a problem of lack of fossil fuels [1], an agronomic approach was developed to produce tomatoes (Solanum lycopersicum L.) in a sustainable way.Thus, a conic geothermal heat exchanger coupled to a geothermal heat pump is used to control the greenhouse climate in Tunisia. This study focuses on the performance of the heating system on the microclimate of greenhouses without neglecting its role in improving crop yield.

We selected to focus on monitoring the ripeness stages of tomato crop under greenhouse heated with geothermal system. Another matter of fact is, on the categorization of crops into marketable and non-marketable.

We found that the excess of energy in the soil inside of the greenhouse has increased the air temperature by 6 °C during typical nights of December to February.

The microclimatic conditions provided by this system had positively affected plant physiological processes which increasing the total yield to (53%), compared to an insulated greenhouse (47%). This technique proved valuable to increase the efficiency of the use of renewable energy. Furthermore, it was found that this system can be used to collect large amounts of geothermic energy. Based on the above-mentioned results, it was concluded that geothermic system can be regarded as a useful tool to increase the yield as well as to reduce amounts of others systems of warming of greenhouse.

Keywords

Solar system,Greenhouse,Tomatoes,Yield

References

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Biography

Dr. Douja Sellami, hasher Master degree from the Faculty of Sciences of Bizerte -Tunisia, 2006 and a PhD in Biology from the Faculty of Sciences of Tunis of the University of El Manar-Tunisia since 2020. Shehas her competence in the study of greenhouse crops and her passion for their improvement. Its open improvement model is based on new ways of using renewable energy. She built this model after years of experience in research, both in biology laboratories and in thermal process laboratories.

Simone Pedrazzi
Assistant Professor of Thermal-Fluid Sciences, University of Modena and Reggio Emilia, Dept. of Engineering “Enzo Ferrari”, Via Vivarelli 10/1 – 41125 Modena, Italy

Coupling Gasification and Biochar Co-Composting as a Key for Sustainable Municipal Green Waste Valorization

Abstract
In these last years, several sets of environmental problems were gradually developed ranging from a huge production of solid urban wastes and its disposal to the substantial greenhouse gas emissions such ad nitrous oxide, methane and carbon dioxide. For this reason, we analyzed and gave value to biochar in two different settings, to evaluate its greenhouse gas emissions reduction ability in the composting process, as its water retention ability in a substratum for vase growing. In this study we analyzed positive results accomplished from the pilot-scale experimental work of a quantitative reduction of cumulative methane emissions, nitrous oxide, ammonia, and carbon dioxide for computing analytical correlation, that allows to evaluate system’s emissions on a large scale. Twelves compost bins were installed making up a FORSU blend and two different types of biochars, fine and course grain size. Methane and nitrous oxide emissions were significantly reduced. Basing on these results and basing on data provided by a company, we analyzed the emission factor parameter, with whom it has determined a linear correlation, that it allowed to estimate the emissions produced by a composting plant in case itwill be employed coarse and fine biochar. The most important results in terms of abatement have beenobtained from course biochar, just as the nitrous oxide one. Moreover, a scenario where a gasifier is used to produce the biochar needed for the composting process starting from wood waste has been investigated. Finally, in conclusion we can say that biochar’s application in composting process can be a valid investment for emissions reduction and green energy production.

Biography
Simone Pedrazzi holds M.Sc. and Ph.D. degrees in Mechanical Engineering at the University of Modena and Reggio Emilia. He works as assistant professor of Thermodynamics and Heat Transfer at the same university, and he is a co-founder of the Bio Energy Efficiency Lab (BEELab) (www. beelab.unimore.it). His main research topics are: thermochemical models and experimental tests on biomass gasification, renewable sources integration, waste biomass valorization, cost-benefit analysis of biomass to power systems.

Rodrigo Trentini Preuss
Federal Institute of Santa Catarina, Brazil

Usage of Predictive Controllers for Primary Control and Stabilisation of Power Plants

Abstract
Power systems are the most complex structure ever developed by man. The connection of several generators, prime movers, transmission lines, busbars, etc., led to very intrincate and sophisticate systems. In most cases, the size of such mathematical models prevents the usage of predictive controllers for primary control in actual power systems mainly due to the computational cost. For MPCs, the size of the matrices/vectors used to generate the control signal increase with the system order and the prediction horizon. Given that nowadays several electronic devices applied in power systems work with time steps of a few miliseconds or even less, the prediction horizon becomes large too. This presentation will deal with two candidate techniques to implement predictive controllers for primary control and stabilisation of power plants, using namely the Generalised Miminum Variance Controller (GMVC) and the Unrestricted Horizon Predictive Controller (UHPC).

Biography
Rodrigo Trentini received the B.Sc. degree in Control and Automation Engineering from the Instituto Superior Tupy, Joinville, Brazil, the M.Sc. degree in Electrical Engineering from the University of the State of Santa Catarina, Joinville, Brazil, and the Ph.D. degree in Electrical Engineering from the University of Hannover, Germany, in 2010, 2012 and 2017, respectively. Since 2018 he has been an Adjunct Professor with the Department of Electrical Engineering at the Federal Institute of Santa Catarina, campus Jaraguá do Sul (Rau), Brazil. His research interests include Power Systems modelling and control, Renewable Energy, Control Theory and Mechatronics.

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