CONFERENCE ABSTRACT

Full Virtual Style / October 21-23, 2021

ICPSE 2021
2021 10th International Conference on Power Science and Engineering

Workshop: ICREE 2021
It is our great pleasure to welcome you to attend 2021 10th International Conference on Power Science and Engineering (ICPSE 2021) and its workshop: ICREE 2021.

Considering the global travel restrictions at present, also in order to have a better academic communication circumstance, we had to make the decision to hold ICPSE 2021 in full virtual style on Oct. 21-23, 2021.

We were looking forward to meeting everyone in Istanbul, but only full virtual conference can gather all participants together in current situation. Hope it will be a rewarding experience for all participants. We would like to appreciate our conference committees for putting everything of the conference together, and all the technical committee members and reviewers for their excellent work in reviewing the papers and their efforts. We are grateful to all those who have contributed to the success of the conference in 2021.

Please stay aware of the latest information on the epidemic, and don’t neglect basic protective measures. Hope all of you can be safe and healthy! We are looking forward to meeting you in site next year.

ICPSE 2021 Organizing Committees
Conference Committees

International Advisory Committee
• Fangxing Li, The University of Tennessee, USA
  (IEEE Fellow, Editor-In-Chief of IEEE Open Access Journal of Power and Energy)

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• Donal Finn, University College Dublin, Ireland
• Ozan Erdinç, Yildiz Technical University, Turkey (IEEE PES Turkey Chapter Chair, IEEE Senior Member)

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• Yavuz Ateş, Yildiz Technical University, Turkey

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• Reinhard Haas, Vienna University of Technology, Austria
• Gianfranco Chicco, Politecnico Di Torino, Italy (IEEE Fellow, Vice-Chair of the IEEE Italy Section)
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- Mohammad Nurul Islam, Universiti Teknologi Brunei, Brunei Darussalam
- Ruslan V. Sharapov, Murom Institute of Vladimir State University, Russia
- Samuel Lakeou, University of the District of Columbia, USA
- Doris Esenarro, Environmental and Ecotourism Engineering, UNFV, Peru
- Sima Davarzani, UK Power Networks, UK
- Florin Onea, "Dunărea de Jos" University of Galati, Romania
- Eugen Rusu, "Dunărea de Jos" University of Galati, Romania
- Alberto Jesús Perea Moreno, University of Cordoba, Spain
- John Njagi Nguu, Daystar University, Kenya
- Lana Migla, Riga Technical University, Latvia
- Yuri Bulatov, Bratsk State University, Russia
- Konstantin Suslov, Irkutsk National Research Technical University, Russia
- Mahmoud Z. Abu-Zaid, Mutah University, Jordan
Participants’ Guideline

Install ZOOM or use official website  URL:  https://zoom.com.cn/download

Join a Meeting without Sign In
Enter the conference ID: 958 6946 5989 to join the conference room. Please note that the room ID for parallel session 2 and session 4 is 820 4051 8439.

Set Names as
Author: Paper ID + Name  Listener: Listener + Name
Keynote Speaker: KN + Name  Committee: Position + Name

Tips for your presentation
✓ Please join in the online meeting room by ZOOM in advance and check your ZOOM software, earphone and microphone in advance in order to have a smooth presentation.
✓ Please open all of the windows (PPT files, websites, etc.) that you will need to share before you start.
✓ Each regular author has 15 minutes for presentation, including Q&A part. Please unmute audio and start video while your presentation.
✓ Make sure you’re in a quiet room with proper lighting and stable internet connection.
### Zoom Test Schedule

#### October 21, 2021 | Thursday

<table>
<thead>
<tr>
<th>Time (GMT+3)</th>
<th>Paper ID</th>
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<tbody>
<tr>
<td>8:30 am—10:00 am</td>
<td>CE004, CE009, CE014, CE015, CE024, CE027, CE028, CE5002, CE5005, CE5006</td>
</tr>
<tr>
<td>10:00 am—11:30 am</td>
<td>CE001, CE003, CE006, CE019, CE021, CE030, CE519, CE523, CE1001, CE1002</td>
</tr>
<tr>
<td>11:30 am—1:00 pm</td>
<td>CE007, CE016, CE023, CE029, CE502, CE503, CE513, CE514, CE515, CE521</td>
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</table>

※ Please choose a time period that is convenient for you to complete the ZOOM test, which may only cost you 10 minutes.

Room ID: 958 6946 5989
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>9:30 am</td>
<td>Online Meeting Room Open</td>
<td>(Note: Please join in the meeting room before 10:15 am.)</td>
</tr>
<tr>
<td>10:30 am—10:40 am</td>
<td>Opening Remarks</td>
<td>Prof. Ozan Erdinç</td>
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<td>IEEE PES Turkey Chapter Chair, IEEE Senior Member</td>
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<td>Yildiz Technical University, Turkey</td>
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<tr>
<td>10:40 am—11:20 am</td>
<td>Keynote Speech I</td>
<td>Prof. Gianfranco Chicco</td>
</tr>
<tr>
<td></td>
<td>Speech Title: Data-driven Approaches</td>
<td>IEEE Fellow</td>
</tr>
<tr>
<td></td>
<td>for Smart Grid Applications</td>
<td>Politecnico Di Torino, Italy</td>
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<tr>
<td>11:20 am—12 pm</td>
<td>Keynote Speech II</td>
<td>Prof. Bikash Pal</td>
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<tr>
<td></td>
<td>Speech Title: Robust Volt-Var Control</td>
<td>IEEE Fellow</td>
</tr>
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<td></td>
<td>in Power Distribution</td>
<td>Imperial College London, UK</td>
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<tr>
<td>12 pm—2 pm</td>
<td>Group Photo Taking &amp; Break Time</td>
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# Meeting Agenda

**October 22 | Friday (GMT+3)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>2 pm—2:40 pm</td>
<td><strong>Keynote Speech III</strong></td>
<td><strong>Prof. João P. S. Catalão</strong></td>
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<tr>
<td></td>
<td>Speech Title: Singular Landmark for the Energy</td>
<td>IEEE Senior Member</td>
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<td></td>
<td>Transition on EU Islands</td>
<td>University of Porto, Portugal</td>
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<tr>
<td>2:40 pm—3 pm</td>
<td><strong>Break Time</strong></td>
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<tr>
<td>3 pm—3:40 pm</td>
<td><strong>Keynote Speech IV</strong></td>
<td><strong>Prof. Fangxing Li</strong></td>
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<td></td>
<td>Speech Title: Cybersecurity Defense Against False</td>
<td>IEEE Fellow</td>
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<td></td>
<td>Data Injection Attack (FDIA) using Market Price</td>
<td>The University of Tennessee, USA</td>
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<td>Signals</td>
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<tr>
<td>3:40 pm—4 pm</td>
<td><strong>Invited Speech I</strong></td>
<td><strong>Dr. Amela Ajanovic</strong></td>
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<tr>
<td></td>
<td>Speech Title: The Role of Hydrogen in the Energy</td>
<td>Vienna University of Technology, Austria</td>
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<td>Transition and Transport Transformation</td>
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Conference Host: **Prof. Reinhard Haas**, Vienna University of Technology, Austria
<table>
<thead>
<tr>
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<td><strong>Online Meeting Room Open</strong></td>
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<td><em>(Note: Please enter the Room ID: 958 6946 5989 to join in the meeting before 8:45 am.)</em></td>
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<tr>
<td>9 am—9:20 am</td>
<td><strong>Invited Speech II</strong></td>
<td><strong>Dr. Ahmet Doğan</strong></td>
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<tr>
<td></td>
<td>Speech Title: Applications of Heuristic Algorithms to Power System Problems</td>
<td><strong>Nuh Naci Yazgan University, Turkey</strong></td>
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<tr>
<td>9:20 am—9:40 am</td>
<td><strong>Break Time</strong></td>
<td></td>
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<tr>
<td>9:40 am—11:40 am</td>
<td><strong>Parallel Session 1 for Authors’ Presentations</strong></td>
<td><strong>CE019, CE1002, CE009, CE004, CE023, CE1001, CE007, CE016</strong></td>
</tr>
<tr>
<td>9:40 am—11:10 am</td>
<td><strong>Special Session for Authors’ Presentations</strong></td>
<td><strong>CE001, CE021, CE024, CE030, CE029, CE006</strong></td>
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<tr>
<td>11:40 am—1:30 pm</td>
<td><strong>Break Time</strong></td>
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<tr>
<td>Time</td>
<td>Activity</td>
<td>Speaker</td>
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| 1:30 pm—1:50 pm  | **Invited Speech III**  
Speech Title: DERMS Deployment in UK Power Networks as a Key DSO Enabler | Dr. Sima Davarzani  
UK Power Networks, UK |
| 1:50 pm—2:10 pm  | **Invited Speech IV**  
Speech Title: Flexible Management of EV Parking Lots Charging Demands in Distribution Systems | Dr. İbrahim Şengör  
İzmir Katip Çelebi University, Turkey |
| 2:10 pm—2:30 pm  | **Break Time**                                                          |                                                  |
| 2:30 pm—4:30 pm  | **Parallel Session 3 for Authors’ Presentations**  
Room ID: 958 6946 5989 | CE5002, CE5005, CE5006, CE015, CE502, CE513, CE514, CE519 |
| 2:30 pm—4:30 pm  | **Parallel Session 4 for Authors’ Presentations**  
Room ID: 820 4051 8439 | CE003, CE014, CE027, CE028, CE503, CE515, CE521, CE523 |
| 4:30 pm—4:40 pm  | **Best Presentation Awards Announcement & Closing Remarks**  
Prof. Donal Finn, University College Dublin, Ireland |                                                  |
Abstract: In the evolution of the electrical systems in the smart grid context, the amount of data available is increasing considerably. Data-driven solutions are emerging as alternatives to model-based approaches. New tools are being developed to handle the flow of data gathered during time from different sources. The presentation highlights various aspects referring to data-driven approaches, from consistency of the data to the challenging task of transforming data into knowledge. Specific focus is set on the nature and quality of the data, the role of data uncertainty, and the role of the expert of the domain in verifying the meaningfulness of the available data and in identifying the most effective usage of the data in the smart grid applications.

Biography: Gianfranco Chicco holds a PhD in Electrotechnics Engineering and is a Full Professor of Power and Energy Systems at Politecnico di Torino (POLITO) in Torino, Italy. He is a Fellow of the IEEE (Power and Energy Society). He received the title of “Doctor Honoris Causa” from the University Politehnica of Bucharest (Romania) and from the Technical University “Gheorghe Asachi” of Iasi (Romania) in 2017 and 2018, respectively. He is the vice-Chair of the IEEE Italy Section. More information about Prof. Gianfranco Chicco, please visit: http://icpse.org/keynote.html.
Abstract: Electrical generation, transmission and distribution systems all over the world have entered a period of significant renewal and technological change. There have been phenomenal changes/deployments in technology of generation driven by the worldwide emphasis on energy from wind and solar as a sustainable solution to our energy need. Increasingly energy demand from heating and transportation are being met by electricity. These changes have significantly influenced the planning, design, operation and control of the power distribution system. Accommodating uncertainties in renewable generation and demand forecast in a cost-effective manner is now a very complex optimization problem. This talk will share our recent research efforts Volt/VAr control (VVC) strategy in distribution systems to address the uncertainties. Efficient chance constrained conic optimisation technique accelerated through scenario reduction approach will be discussed to demonstrate the significant reduction of voltage violations when compared with the deterministic cases while not relaxing the conservativeness of the final solutions. It will also touch upon treatment of certain types of load characteristic in the proposed solution framework. Future research challenges and opportunities will be highlighted.
Biography: Bikash Pal is a Professor of Power Systems at Imperial College London (ICL). He is research active in power system stability, control, and estimation. Currently is leading a six university UK-China research consortium on Resilient Operation of Sustainable Energy Systems (ROSES) as part of EPSRC-NSFC Programme on Sustainable Energy Supply. He led UK-China research consortium project on Power network stability with grid scale storage (2014-2017): He also led an eight- university UK-India research consortium project (2013-2017) on smart grid stability and control. His research is conducted in strategic partnership with ABB, GE Grid Solutions, UK, and National Grid, UK. UK Power Networks. GE commissioned sequel of projects with him to analyse and solve wind farm HVDC grid interaction problems (2013-2019). Prof Pal was the chief technical consultant for a panel of experts appointed by the UNFCCC CDM (United Nations Framework Convention on Climate Change Clean Development Mechanism). He has offered trainings in Chile, Qatar, UAE, Malaysia and India in power system protections, stability and control topics. He has developed and validated a prize winning 68-bus power system model, which now forms a part of IEEE Benchmark Systems as a standard for researchers to validate their innovations in stability analysis and control design. He was the Editor-in-Chief of IEEE Transactions on Sustainable Energy (2012-2017) and Editor-in-Chief of IET Generation, Transmission and Distribution (2005-2012). He is Vice President, PES Publications (2019-). In 2016, his research team won the President’s outstanding research team award at Imperial College London (ICL). He is Fellow of IEEE for his contribution to power system stability and control. He is an IEEE Distinguished Lecturer in Power distribution system estimation and control. He was). He has published about 100 papers in IEEE Transactions and IET journals and authored four books in power system modelling, dynamics, estimations and control. More information about Prof. Bikash Pal, please visit: [http://icpse.org/keynote.html](http://icpse.org/keynote.html).
Prof. João P. S. Catalão, IEEE Senior Member, University of Porto, Portugal

Senior Editor of the IEEE Transactions on Smart Grid
Promotion and Outreach Editor of the IEEE Open Access Journal of Power And Energy

Speech Title: Singular Landmark for the Energy Transition on EU Islands

Abstract: A large share of renewable energy sources installed capacity is taking place in insular electricity grids. However, the increasing renewables penetration in the generation mix of insular power systems presents a big challenge in the efficient grid management, mainly due to the limited predictability and the high variability of renewables, in conjunction with the relevant small size of most of these networks. This Keynote Speech addresses the effects of large-scale integration of renewables on the planning and operation of insular power systems, presenting efficient solutions and tools towards the development of a sustainable and smart grid. Different insular electricity grids in five countries across Europe will be highlighted.

Biography: João P. S. Catalão received the Ph.D. degree and Habilitation for Full Professor ("Agregação") from the University of Beira Interior (UBI), Covilha, Portugal, in 2007 and 2013, respectively. Currently, he is a Professor at the Faculty of Engineering of the University of Porto (FEUP), Porto, Portugal. He was the Primary Coordinator of the EU-funded FP7 project SiNGULAR ("Smart and Sustainable Insular Electricity Grids Under Large-Scale Renewable Integration"), a 5.2-million-euro project involving 11 industry partners. He has authored or coauthored more than 850 publications, including 400 journal papers (125 IEEE Transactions/Journal papers), 400 conference proceedings papers (vast majority co-sponsored by IEEE), 5 books, 41 book chapters, and 14 technical reports, with an h-index of 67, an i10-index of 315, and over 17,000 citations (according to Google Scholar). He was the General Chair of SEST 2019, technically sponsored by IEEE PES and IEEE IES. More information about Prof. João P. S. Catalão, please visit: http://icpse.org/keynote.html.
**Speech Title: Cybersecurity Defense Against False Data Injection Attack (FDIA) using Market Price Signals**

**Abstract:** Traditional cyberattack strategies on electricity markets only consider bypassing bad data detections. However, our analysis shows that experienced market operators can detect abnormal locational marginal price (LMP) signals under the traditional false data injection attack (FDIA) model during real-time operations, because such attack model ignores the characteristics of the LMP itself and leads to price spikes that can be an easy-to-detect signal of abnormality. Thus, a detection approach based on the concept of critical load level (CLL) is proposed to help operators identify risky periods when operators would be prone to overlooking abnormal LMPs. This gives a new defense line for market operators to detect FDIA. Next, a new LMP-disguising attack strategy is proposed to bypass the LMP-based detection algorithm. Finally, a comprehensive cyber-vulnerability assessment is proposed to identify four risk targets of cyberattacks to enhance the defense strategy of market operators. Test results from two IEEE test systems as well as the WECC and synthetic ERCOT systems are presented to demonstrate the proposed research results in the CURENT Large-scale Testbed (LTB) platform.
Biography: Professor Fangxing “Fran” Li received the B.S.E.E. and M.S.E.E. degrees from Southeast University, Nanjing, China, in 1994 and 1997, respectively, and the Ph.D. degree from Virginia Tech, Blacksburg, VA, USA, in 2001. He had worked at ABB Consulting in Raleigh, NC as a Senior Engineer and then a Principal Engineer from 2001 to 2005. He has been a faculty member at The University of Tennessee, Knoxville (UTK) since 2005. Currently, he is a James McConnell Professor in electrical engineering at UTK and the Campus Director of CURENT, an NSF/DOE Engineering Research Center headquartered at UTK. His research interests include renewable energy integration, demand response, power markets, power system control, and power system computing.

Professor Li has received numerous research awards including R&D 100 Award in 2020 for the CURENT LTB project and the IEEE PES Technical Committee Prize Paper award in 2019. Presently, he is serving as the Editor-In-Chief (EIC) of IEEE Open Access Journal of Power and Energy (OAJPE) and the Chair of IEEE Power System Operation, Planning and Economics (PSOPE) committee. He is a Fellow of IEEE.
Abstract: Pressing environmental problems are accelerating the energy transition and the transformation of the transport sector. In this context, an issue of interest is to link the electricity sector and the transport sector via hydrogen. Over the last years it can be noticed increasing use of fluctuating renewable energy sources such as wind power and solar energy all over the world. However, with the increasing use of variable energy sources, balance between energy supply and demand is becoming more challenging. A specific challenge is how to store surpluses electricity. One opportunity is to produce hydrogen which can be used in different mobility applications such as fuel cell cars, trucks, locomotives, ships and even airplanes. Although, battery electric vehicles have been significantly improved over the last decade, hydrogen in combination with fuel cell vehicles is seen as a better solution in the case of larger vehicles and longer driving distances but in the long term. Hence, a coupling of electricity production from renewables and decarbonisation of the transport sector could provide a great chance for hydrogen use as a fuel for mobility and storage for surplus electricity.
Dr. Ahmet Doğan, Nuh Naci Yazgan University, Turkey

Speech Title: Applications of Heuristic Algorithms to Power System Problems

Abstract: Power demand is increasing day by day due to the rapid growth in population, industrialization and urbanization. In addition, the complexity of the power system has significantly increased in recent years as a result of the enlarged capacity of environmentally friendly components such as renewable energy sources, battery storage systems and electric vehicles. Therefore, system operators require some advanced analysis tools for optimum planning and smooth operation of complicated systems. Electrical power systems have so greatly benefited from developments in the use of optimization techniques to obtain convenient solutions. Especially, heuristics algorithms provide great ease to obtain optimum solutions. Therefore, the focal points of the presentation are the applications of heuristic algorithms to various power system problems and evaluation of their advantages/disadvantages from different aspects.
Dr. Sima Davarzani, UK Power Networks, UK

*Speech Title: DERMS Deployment in UK Power Networks as a Key DSO Enabler*

**Abstract:** UK Power Networks is United Kingdom’s largest Distribution Network Operator (DNO) for electricity covering three licensed distribution networks in South East England, the East of England and London. It altogether manages an area of 30,000 square kilometres with 9.2GW of distributed generation and serves approximately twenty million population. UK Power Networks is developing capabilities to perform role of Distribution System Operator (DSO). This will build on the foundation laid over the last 6 years in connecting and managing flexible Distributed Energy Resources (DERs) and develop new capabilities in dispatching flexibility services and facilitating new markets in order to ensure that customer needs are met, reliability is maintained and decarbonisation of the electricity system is delivered at the least cost. In line with this strategy, UK Power Networks is rolling out advanced Distributed Energy Resources Management System (DERMS) that optimises the operation of the network and unlocks new capacity with efficient use DER. The new solution provides a scalable platform that can maximise the use of the services offered by an individual DER or an aggregation of DERs while coordinating with National Grid ESO and Intelligent Electronic Devices (IEDs) installed in the distribution network.
Abstract: With the developing technology, it is obvious that the charging requirements of the electric vehicles (EV) which are expected to replace the internal combustion engine vehicles will adversely affect the existing electricity grid. Thanks to the smart grid concept, the increased charging requirements of electric vehicles, one of the new generation loads, can be effectively handled by energy management algorithms. In fact, the idea of controlling these loads, which can provide operating flexibility to the system operator, has motivated many researchers around the world. This talk delivers energy management models for charging scheduling of EVs in public parking lots in distribution system operators point of view. Moreover, the effectiveness of the proposed systems is validated with credible results and useful findings obtained by the evaluated models.
Session Chair: Prof. Konstantin Suslov, Irkutsk National Research Technical University, Russia
IEEE Senior Member, Vice-chair of Russian (Siberian) chapter of IEEE PES

Topic: Power System Engineering and Power Electronics Technology

Please join the conference room 15 minutes in advance before the session starts.

The best presentation will be selected and announced at the end of October 23.

Presentation certificates will be sent by emails after the conference.
Title: The Study of Synchronous Generators' Voltage and Frequency Group Prognostic Controllers of a Small-scale Hydroelectric Power Plant
Presenter: Konstantin Suslov, Irkutsk National Research Technical University, Russia

Abstract: The application of a large number of distributed generation plants, built on the basis of synchronous generators in electric energy system (EES), requires solving the problem of their centralized control, adjustment of voltage and frequency local controllers, which entails taking into account a large number of interrelated system parameters. These problems can be solved using prognostic control algorithms. The purpose of the study was to determine the effect of the proposed group prognostic voltage and frequency controllers for small-scale hydroelectric power plant (HPP) on various operating modes of the EES. The studies were conducted in the MATLAB environment using the Simulink and SimPowerSystems simulation packages. The results of computer simulation indicate that the use of group prognostic controllers significantly reduces overshoot, oscillability index, transient time and voltage dips, and frequency in the normal and emergency conditions. The proposed methods of the group prognostic controllers formation and tuning allow to improve quality indices of small-scale HPP voltage and frequency control, while retaining the former settings of synchronous generators controllers.
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<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter</th>
<th>Abstract</th>
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<tbody>
<tr>
<td>CE019</td>
<td><strong>Using Recurrent Neural Network to Forecast Day and Year Ahead Performance of Load Demand: A Case Study of France</strong></td>
<td>Diaa Salman, Cyprus International University, Turkey</td>
<td>The rate of growth of countries all over the world is increasing dramatically and is unavoidable, resulting in an increase in energy consumption. Moreover, fast residential and commercial development contributes to an increase in construction energy usage. Energy consumption forecasting has become critical for predicting power consumption. One of the most significant factors in power system design and operation is load forecasting. Load forecasting for power systems is a critical feature in both the economy and developed businesses. In this research a well-defined machine learning algorithm termed Recurrent Neural Networks (RNN) is exploited to forecast the day and year ahead performance of the load demand of France.</td>
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<tr>
<td>CE1002</td>
<td><strong>Finite Element Calculation Loss Analysis of Large Transformers Under the Influence of GIC</strong></td>
<td>Zhuwen Dai, Shenyang Institute of Engineering, China</td>
<td>The important feature of transformers under GIC conditions is local overheating, which can lead to insulation damage if the temperature is too high and thus reduce the life of the transformer. The magnetizing current of the transformer under DC bias will have harmonic components, and the increase of harmonics will lead to local overheating, therefore, transformer losses under DC bias need to be studied. In this paper, based on the international standard IEEE C57.163 of power transformers, combining the circuit model and finite element simulation to calculate the magnetization current and harmonic components of the transformer under GIC conditions. The magnetization current is used as input to simulate the magnetic flux density of the structural components of this transformer and to analyze its loss effects.</td>
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<tr>
<td>Time</td>
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<tr>
<td>10:25 am - 10:40 am</td>
<td><strong>Title: Optimization of Antenna Array for Partial Discharge Positioning in Substation based on Cramér–Rao Lower Bound</strong>&lt;br&gt;<strong>Presenter: Guobin Feng, Xi'an Jiaotong University, China</strong></td>
<td></td>
<td><strong>Abstract:</strong> Partial discharge is an important symbol of insulation defects. Partial discharge detection system based on UHF antenna array can realize partial discharge location in air-insulated substation. Using spatial spectrum estimation can reduce the antenna array and achieve high-precision positioning with smaller array size. This paper discusses the direction finding accuracy of different antenna arrays with the help of Cramér–Rao lower bound. Through theoretical derivation and numerical calculation, the influence of array structure on direction finding performance is studied, which provides guidance for optimizing antenna array. The results show that in order to achieve high direction finding accuracy, the offset $B$ in the analytical expression of array factor $q$ should be as large as possible, and the amplitude $A$ and initial phase $\gamma$ should be selected reasonably according to the application requirements. The farther a single burst deviates from the original equilibrium position, the more drastic the change of the Cramér–Rao lower bound with the variable azimuth angle, and the worse the comprehensive direction finding performance.</td>
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<tr>
<td>10:40 am - 10:55 am</td>
<td><strong>Title: State-of-Charge Estimation of Lithium-Ion Batteries Using Extended Kalman Filter</strong>&lt;br&gt;<strong>Presenter: Mohamed Redha Rezoug, University Kasdi Merbah, Algeria</strong></td>
<td></td>
<td><strong>Abstract:</strong> The lithium-ion technology has rapidly imposed itself in the world of electronics consumer and electric vehicles. It offers high energy density, very good durability and is not subject to the memory effect. Determining some parameters such as the batteries state of charge (SoC), and obtaining an accurate battery model is mandatory in this field. In this paper, an improved algorithm...</td>
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is proposed to estimate the SoC of a cylindrical lithium cell type 18650 with the help of Matlab/Simulink using experimental data. To simulate the battery behaviour, a mathematical model of a second-order Thevenin circuit is developed. For the internal parameters identification an Extended Kalman Filter (EKF) is used. The aim of this work is to approximate to the most accurate values of the internal parameters of this nonlinear system in order to increase the accuracy of the SoC estimation process based on the advantages of the EKF algorithm.

Title: Research on Dual-terminal Flexible HVDC Transmission System Based on Renewable Energy Access  
Presenter: Kaiyuan Wang, The University of Hong Kong, China

Abstract: With the increasing demand for renewable energy and development of flexible direct current transmission technology (VSC-HVDC), VSC-HVDC system with renewable energy access has gradually became a research hotspot. Based on the above situations, this paper studies the topology and operation mechanism of a VSC-HVDC system with renewable energy access. For the choice of converter topology structure, this paper adopts the traditional two-level converter. For the control system, one end adjusts the DC voltage and reactive power, and the other end is used to regulate the active power and reactive power to meet the operation requirement. In order to further enrich the energy transmission path of dual-terminal VSC-HVDC system, a renewable energy system based on passive inverter is connected to the dc line. Furthermore, by introducing unipolar PWM modulation and designing line filter inductance, the three-terminal VSC-HVDC system based on renewable energy access will achieve ideal operation and flexible system control. Finally, the effectiveness is verified on MATLAB/Simulink simulation platform. The results show that the power received by the receiver is determined by the power emitted by the sender and the power received by the new energy branch when the receiver adopts constant DC voltage control.
**Title:** Accurate Power Sharing and Synchronization Strategies in Mesh Islanded or Grid-connected Microgrids  
**Presenter:** Youssef Hennane, Université de Lorraine, France

**Abstract:** In microgrids with a high penetration rate of distributed generators (DGs), the intermittency of renewable energy can cause microgrid instability, especially in islanded mode. In this case, it can be connected to the main grid; this possibility also improves its reliability and voltage quality. The transition between the islanded mode and the grid-connected mode of the microgrid requires an efficient synchronization strategy that doesn’t affect power sharing between different DGs connected to the microgrid. Many researchers have already studied and discussed power sharing and synchronization strategies to ensure a seamless transition between the two operating modes of the microgrids for which several DGs and Loads are connected to the same Point of Common Coupling (mono-PCC microgrids). In this paper, a nonlinear distributed control for DGs synchronization to the microgrid as well as active and reactive power sharing in islanded and grid-connected mesh microgrids is proposed while the real characteristics of the power lines connecting the PCCs are considered. In addition, an investigation of communication delay impact on the proposed control is also conducted. The simulation results using Simulink/Simscape and experimental results using the Hardware-in-the-Loop (HIL) real time simulation in opal-rt and dSPACE platforms confirm the effectiveness of the proposed strategies.

**Title:** Prediction of Energy Consumption for Variable Customer Portfolios Including Aleatoric Uncertainty Estimation  
**Presenter:** Oliver Mey, Fraunhofer IIS/EAS, Fraunhofer Institute for Integrated Circuits, Division Engineering of Adaptive Systems, Dresden, Germany
Abstract: Using hourly energy consumption data recorded by smart meters, retailers can estimate the day-ahead energy consumption of their customer portfolio. Deep neural networks are especially suited for this task as a huge amount of historical consumption data is available from smart meter recordings to be used for model training. Probabilistic layers further enable the estimation of the uncertainty of the consumption forecasts. Here, we propose a method to calculate hourly day-ahead energy consumption forecasts which include an estimation of the aleatoric uncertainty. To consider the statistical properties of energy consumption values, the aleatoric uncertainty is modeled using lognormal distributions whose parameters are calculated by deep neural networks. As a result, predictions of the hourly day-ahead energy consumption of single customers are represented by random variables drawn from lognormal distributions obtained as output from the neural network. We further demonstrate, how these random variables corresponding to single customers can be aggregated to probabilistic forecasts of customer portfolios of arbitrary composition.
Special Session

Topic: Energy Trading and Market Participation of Electrical Vehicles

Session Chair: Asst. Prof. Mohammad Reza Salehizadeh, Marvdasht Branch, Islamic Azad University, Iran

✓ Please join the conference room 15 minutes in advance before the session starts.
✓ The best presentation will be selected and announced at the end of October 23.
✓ Presentation certificates will be sent by emails after the conference.
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<tr>
<td>CE001</td>
<td>Innovative Financial Approaches for Procurement on Electric Buses in Sustainable Public Transportation Systems</td>
<td>Orhan TOPAL, Aselsan Inc., Turkey</td>
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<td><strong>Abstract:</strong> Looking across the world an irresistible rise of electric vehicles is observed. The relevant infrastructure and industry sector are also developing rapidly. The advantages of electric vehicles thanks to the technological innovations which they have. However the most important disadvantage confronts is the purchasing costs. Their values have not reached the expected level yet. For this reason, electrical vehicle implementations cannot be achieved in the public transportation, except some cities like Shenzen which is the one of the important city in China. Considering the points mentioned above, many applications are carried out in order to reveal different financial approaches in purchasing electric buses in public transportation systems in worldwide. In this study, purchase methods of electric busses with new business models especially in China, USA and Europe will be included. These methods are targeted to shed light on financial approaches, business model prediction and business analysis for the local governments that provide public transportation service in Turkey. The obtained approach results are expected to shed light on the electric bus route map in Turkey's public transportation systems.</td>
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<td>CE021</td>
<td>Environmental, Economic, and Social Life Cycle Impacts of Alternative Fuel Buses: the Case for Qatar</td>
<td>Nuri C. Onat, Qatar University, Qatar</td>
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Abstract: This paper aimed to evaluate three different types of city buses' life cycle, including the manufacturing, shipping, and operation phases. On this basis, this study is applying both a hybrid life cycle sustainability assessment (LCSA) and multi-objective decision-making to assess two different brands of compressed natural gas (CNG), diesel, and electric buses. This study intends to cover the existing gap in the literature related to the external effects developed from the different fuel buses in Qatar. The results highlighted that adopting the CNG buses favors the social indicators, and they have the lowest life cycle costs. On the other hand, the electric buses support the environmental indicators, and they have slightly higher life cycle costs than CNG buses. The diesel buses had the worst environmental impacts, high social impacts than CNGs, and the highest life cycle costs.

Title: Research on the influencing factors of energy efficiency in the process of urbanization, based on the PSTR model
Presenter: Jiemin Wang, Sichuan University, China

Abstract: The important feature of transformers under GIC conditions is local overheating, which can lead to insulation damage if the temperature is too high and thus reduce the life of the transformer. The magnetizing current of the transformer under DC bias will have harmonic components, and the increase of harmonics will lead to local overheating, therefore, transformer losses under DC bias need to be studied. In this paper, based on the international standard IEEE C57.163 of power transformers, combining the circuit model and finite element simulation to calculate the magnetization current and harmonic components of the transformer under GIC conditions. The magnetization current is used as input to simulate the magnetic flux density of the structural components of this transformer and to analyze its loss effects.
Title: Assessing the Impact of Peer-to-Peer Markets on Distribution Grid Operation
Presenter: Ozan Erdinç, Yıldız Technical University, Turkey

Abstract: Due to the considerable increase of distributed energy resources, a new model of energy trading called peer-to-peer (P2P) has emerged in local energy communities that play a key role in the proliferation of renewable energy sources. However, although local and distributed power trading allows for a more decentralized and open grid, these models have a significant impact on the control, operation, and planning of the electricity distribution grid. Thus, reducing the demand for power at an affordable price is one of the main objectives of P2P markets, considering the different voltage limits and possible congestion existing in the distribution system. Thus, the main goal of this work is to evaluate the impact of the P2P market on the distribution network operation. This work includes an energy community in a neighborhood involving nine connected houses and one school, involving different renewable technologies and energy storage systems installed in each consumer and/or prosumer. The simulation results indicate that in the presence of local distributed generation and the inclusion of energy storage devices and electric vehicles allow a high-cost reduction (16%) and a very positive impact on the distribution system in terms of congestion and voltage deviations.
| CE029 | Title: Influence of Demand Response Programs in Microgrids Facing Photovoltaic and Battery Integration  
**Presenter:** João P. S. Catalão, University of Porto, Portugal |
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<td><strong>Abstract:</strong> Yearly, the number of distributed energy resources (DER) integrated into the power grid increases has increased, having a large impact on power generation globally, promoting the introduction of renewable energy resources (RER). To increase the flexibility of the power system with integrated RER, the introduction of energy storage systems (ESS) is essential. Demand response (DR) programs also help to increase grid flexibility, resulting in increased grid reliability as grid congestion and losses decrease. However, this new paradigm shift needs further research and careful analysis. In this work, two types of DR programs are addressed to promote greater participation by different consumers features. To interconnect the different consumers, DR aggregators are inserted to ensure that individual consumers have influence on the power market. All these aspects, if accompanied by information, measurement, communication, and control systems, give rise to the smart grids, playing an essential role. The results show, considering the worst uncertainty case scenario, that there is a suitable total RER of 2151.50 kW, against 3227.30 kW, by not considering the RER uncertainty.</td>
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| CE006 | Title: Techniques to Compress Time-Series Data  
**Presenter:** R. B. Keskar, Visvesvaraya National Institute of Technology, India |
|---|---|
| **Abstract:** This paper juxtaposes two of the techniques to compress time-series data. As the size of time series data being accumulated is likely to soar, data compression has become crucial in a wide range of applications. This has led to a myriad of data compression techniques for time-series data. In our paper, we have taken two of the well known techniques namely
Chebyshev Compression, a lossy technique and Gorilla Compression, a lossless technique which to the best of our knowledge, have never been compared and examined under the same setting. Rendering a “right” choice of compression technique for a particular application is very difficult. To address this problem, we present a benchmark evaluation that offers a comprehensive comparison of both the techniques. Gorilla performs better whenever we had consecutive data points which are having almost same values whereas, Chebyshev gives good results even when there was no correlation in the dataset. In Chebyshev technique, the data values are discarded after transformation which falls in the absolute range of a pre-determined value(known as threshold). So, the increase in threshold value increased the compression gain but this comes at the cost of information loss.
Session 3

Topic: Environment Ecology Engineering and Renewable Energy

Session Chair: Asst. Prof. Dr. Ahmet Doğan, Nuh Naci Yazgan University, Turkey

✓ Please join the conference room 15 minutes in advance before the session starts.
✓ The best presentation will be selected and announced at the end of October 23.
✓ Presentation certificates will be sent by emails after the conference.
Title: Evaluating the Potential of Using Floating Solar Photovoltaic on 12 Reservoirs of Electricity Generation Authority of Thailand Hydropower Plants  
Presenter: Promsak Sapthanakorn, Chulalongkorn University, Thailand

Abstract: Owing to the energy crisis in Thailand, alternative energy, especially solar energy, must be utilized. According to the PDP (Thailand Power Development Plan), EGAT (Electricity Generation Authority of Thailand) has to use floating solar photovoltaic (FPV) in several dams. The purpose of this study is to evaluate the potential of using FPV on 12 reservoirs of EGAT hydropower plants in Thailand without affecting the normal operation of hydropower plants. The benefits of the FPV plant are analyzed in terms of energy generation using the Perez 1990 algorithm, evaporation reduction using Shuttleworth 1993 algorithm, economic analysis, and greenhouse gas emission reduction. The analysis results are simulated based on the maximum coverage area of FPV that does not influence the normal operation of each reservoir. Based on the amount of energy production of all the considered 12 dams, the Srinagarind Dam can generate the highest power. In the Ubol Ratana dam, the water evaporates at the highest rate. In terms of investment, the production cost mainly depends on the plane of array (POA) of solar irradiance in each dam.

Title: Assessment of the Potential of Adaptive Building in Beirut  
Presenter: Rayanne Hammoud, Saint-Joseph University, Lebanon

Abstract: Adaptive building envelopes consist in having components with possibly variable properties that may adapt to weather conditions in order to increase the energy efficiency. In this paper, a test case consisting of an office space situated in Beirut, Lebanon is considered. A total of 11 envelope properties are considered adaptable. Four different adaptation scenarios corresponding to different adaptation periods are simulated. Comparing the results shows that a weekly adaptation would save a maximum of around 18% of energy consumption compared to an all year round optimization.
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<td>CE015</td>
<td>Hydropower Projects Risk Assessment and Ranking Using Combined SWARA-TOPSIS and FINE-KINNEY Methods</td>
<td>Bouba Oumarou Aboubakar, Xi’an University of Science and Technology, China</td>
<td>Chinese international contracting projects in the African market must effectively address the related risks in order to deliver the projects within the given time and costs due to high uncertainty. The purpose of this paper is to assess the risk factors and categories which are crucial to Chinese hydro-power projects in Cameroon and rank them according to their effect on project success. Based on previous literature and experienced decision makers, 21 risk factors grouped in four risk categories were identified. Based on three hydro-power projects undertaken and seven expert’s opinion, combined methods of FINE KINNEY and SWARA-TOPSIS were used for risk ranking. The results show that the top-ranked risk categories are social and environment risks. Social acceptance by local population is regarded to be the most important risk factor, whereas constraints with environment issues are the lowest ranked risk factor. Short recommendations are thrown for a risk response plan and road map for future contractors.</td>
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<td>CE5002</td>
<td>Design of Green Infrastructure for the Revaluation of the Ventanilla-Peru Wetlands and the protection of the environment</td>
<td>Joseline Quijano, Universdad Nacional Federico Villarreal- UNFV, Perú</td>
<td>The purpose of this research is the design of a green infrastructure that allows a regional conservation area to revalue the Ventanilla wetlands to promote ecotourism through spaces for the conservation of natural resources, turning it into a tourist attraction. The proposal considers design and construction criteria with adequate technology, biodegradable, and sustainable materials where environmental impact is minimized in this context. The collection of information through field visits and the use of different software for the topographic survey. Results show that the infrastructure</td>
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design proposed was validated by a survey of potential users of the place, with 75% of the interviewees agree with the design proposal that allows interaction and harmony with nature, giving it a landscape value, generating local, national and international visitors. The value is in the ecosystem services that the landscape provides to the city due to the design and construction criteria with adequate technology, biodegradable, and sustainable materials minimizing the environmental impact and promote the cultural exchange, preservation, and environmental awareness of the wetland.

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**Title:** A Spatial Analysis of the Offshore Wind Energy Potential Related to the Mediterranean Islands  
**Presenter:** Florin Onea, "Dunărea de Jos" University of Galati, Romania  

**Abstract:** Considering that in the Mediterranean Sea there is a quite defined numerous numbers of relatively densely populated islands, the aim of this work is to provide a more complete picture of the benefits that may occur from the implementation of some offshore wind projects in such island environments. As a first step, the wind speed fields (at 100 m height) provided by the ERA5 dataset is processed to obtain a general image of the entire area. Some significant island environments are targeted, as for example Sardinia, Cyprus, or Malta for which a more detailed analysis is carried out. Considering the Exclusive Economic Zones, the most promising area in terms of the wind conditions are highlighted. This is the case of the areas located near Sardinia or Cyprus, where the average wind speed is close to 9 m/s. The best performances of a wind turbine are expected in the north-western part of this basin, where a generator can operate on a full capacity for at least 6% of the time.
### Title: Reference Levels For Heavy Metals In Soil In The City Of Cerro De Pasco-Peru – 2020

**Presenter:** Heiner Saldaña, National University Federico Villarreal, Perú

**Abstract:** The objective of this research is to determine the reference levels for the heavy metals aluminum, barium, chromium, copper, manganese, lead, and zinc, taking into account the background levels and the physicochemical properties of the soil adjacent to the city of Cerro de Pasco, using the method of the linear equation. A simple random statistical sampling was carried out, obtaining 21 samples composed of 63 simple and superficial samples (0 - 30 cm depth) in an extension of 3201 ha of land. Total heavy metal concentrations were correlated with soil physicochemical parameters. Cation exchange capacity (C.E.C.), organic matter (OM) and pH, obtained a correlation coefficient higher than 0.7 for almost all the metals evaluated, except for chromium manganese, and lead. The linear equations generated from the C.I.C., M.O. and pH, allowed defining the reference levels for aluminum (24439 mg/kg), barium (161 mg/kg), copper (29 mg/kg) and zinc (552 mg/kg), considering UCL95 as the background level since it presented a better statistical fit concerning the descriptive statistics. However, the expression \( NR = \bar{X} + nDE \) was used to establish background levels for chromium (26 mg/kg), manganese (966 mg/kg) and lead (62 mg/kg).

### Title: Techno-environmental Assessment of Integrated Nocturnal Solar Collector and U-tube Ground-source Heat Exchanger for Space Cooling Application in UAE

**Presenter:** Shek Atiqure Rahman, University of Sharjah, UAE

**Abstract:** Due to global warming, cooling demand is increasing all over the world especially in cooling dominated locations. It is challenging to meet the cooling load by using the current facility with existing technology. The purpose of this paper is to introduce the state-of-art coupled nocturnal collector assisted with the borehole ground heat exchanger system working for space cooling applications targeting cooling-dominated locations. A test room is considered to investigate the performance of the proposed system in which the cooling load is 31432.29 MJ determined.
It was found that 1223.39 MJ cooling load is met by the nocturnal collector and the remaining 30208.90 MJ are met by the U-tube ground heat exchanger. The highest load consuming source in the proposed system is by the pump running the ground heat exchanger loop and followed by the compressor next in line. Life cycle analysis is carried out by using Eco Audit CES Edu pack software to investigate the viability of the proposed system. Comparative analysis is also conducted between the proposed case powered by renewable sources and the baseline case operated by fossil fuel. Results suggest that the proposed system consumes 687,500 MJ of energy, 1,742.5 kg of CO₂ emissions in relation to the baseline case that consumes 1,912,500 MJ of energy and 137,500 kg of CO₂ over the 25 years product’s lifespan. In a summary, it could be concluded that the new system is technically and environmentally competitive.

Title: Recovery of Eco-friendly Spaces for Ecotourism and the Integration of Visitors in Morro De Calzada – Peru
Presenter: Doris Esenarro, National University Federico Villarreal, Perú

Abstract: This research work aims to recover eco-friendly spaces for ecotourism. The integration of visitors to Morro de Calzada-Peru, the lack of infrastructure is one of the main obstacles that slow the growth of the tourism sector, limiting the development and enhancement of hundreds of attractions that could attract visitor flows and generate income that would contribute to local development. As is the case of Morro de Calzada, it currently does not have an infrastructure that provides comfort to visitors searching for nature. The same that would allow the integration and pleasant experience. Regarding the methodology used, a case study approach was adopted; the characteristics of the place were identified, the attributes that influence as; tourist infrastructure, climatic factors, floristic composition, among other components of the geographical area. Fundamental data that were taken into account for the execution of the 3D modeled design. Likewise, it was supported by an online survey, which was directed to residents and visitors. In conclusion, a design proposal is proposed as a development model that seeks to integrate conservation and care of the environment by applying clean technologies.
October 23, Saturday | 2:30 pm—4:30 pm (GMT+3)
Room ID: 820 4051 8439

Topic: Energy and Power Engineering

Session Chair: Asst. Prof. Dr. Sıtkı Güner,
Eskişehir Technical University, Eskişehir, Turkey

✓ Please join the conference room 15 minutes in advance before the session starts.
✓ The best presentation will be selected and announced at the end of October 23.
✓ Presentation certificates will be sent by emails after the conference.
Title: Design and CFD Analysis of Biomimetic Turbine Blade for Low-velocity Tidal Streams  

Presenter: Emil Christian R. Luna, Mapúa University, Philippines  

Abstract: A Horizontal Axis Tidal Turbine blade with an NREL S814 profile was designed and optimized for low-velocity tidal streams using QBlade. The optimized blade is then integrated with a biomimetic concept and modeled. This biomimetic concept took inspiration from the protuberances on the pectoral fins of Megaptera novaeangliae or Humpback Whale. Two biomimetic configurations, namely 0.15C and 0.2C, were incorporated to a baseline blade. These blades are then subjected to steady-state filtering to see which biomimetic configuration has the highest coefficient of lift and glide ratio at 0° to 20° angle of attack at an inlet velocity of 0.5 m/s. The result showed that the 0.2C configuration has the highest CL/CD, which is 6.3109 at a 10° angle of attack. 0.2C also produced a CL of 0.6115 at 19° before it stalled at 20°. 0.15C produced a CL/CD of 6.1551 at 10° and CL of 0.5883 at 18° before it stalled at 19° while the baseline blade, 0.0C, stalled at 8° and produced a CL/CD of 5.3008 and CL of 0.2402 at 7°. The 0.2C configuration was then integrated into a HATT setup and was then subjected to transient simulation at inlet velocities of 0.5, 0.64, and 1.136 m/s and a specified Tip Speed Ratio of 6. The Biomimetic HATT produced a Torque of 174.914 Nm, 288.955 Nm, 918.054 Nm, Thrust of 1299.09 N, 2134.20 N, 6742.34 N, and Power of 262.371 W, 554.794 W, and 3128.728 W at 0.5, 0.64, and 1.136 m/s inlet velocities, respectively. The results showed that it has 37.46% lesser torque and 6.13% lesser power output at 0.64 m/s. At 1.136 m/s inlet velocity, it has a 36.93% lesser torque and 5.39% lesser power output when compared to a BEM modified blade designed at a TSR of 4. The biomimetic HATT performed better than the blade design of [3] and [4] since this biomimetic design has lesser torque and higher rotational velocity at (a) almost the same power output, (b) same inlet velocities, and (c) the same swept area. Furthermore, the high TSR operation reduces cost in the design of the power take-off system since it can employ direct drive mechanisms.
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<td>2:45 pm-3:00 pm</td>
<td><strong>Fatigue Testing of the Small Wind Turbine Blade</strong>&lt;br&gt;<strong>Presenter:</strong> Jakub Bobrowski, Lodz University of Technology, Poland</td>
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<td><strong>Abstract:</strong> Blades are the elements of a wind turbine which are the most vulnerable to destruction. Facing the unstable wind (one that changes its speed and direction), they are subjected to cyclic and fluctuating loads. This problem is particularly pronounced in case of small wind turbine (SWT) blades or blades for wind tunnel tests in scale, which are oftentimes made of anisotropic materials or manufactured in a way leading to anisotropy, like 3D-printing. SWT blades have to be designed in a way which will allow them to operate for a long time without any fracture. Hence, the fatigue strength is a key parameter, which determines their operation time and should be tested before putting a wind turbine into operation. The aim of this paper is to describe the methodology of fatigue tests of the small wind turbine blades. Next, the construction of the fatigue test stand and results of the experiment will be examined.</td>
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<td>3:00 pm-3:15 pm</td>
<td><strong>An Accurate and Convergent Discretization to Simulate Transient Heat Conduction in Wind Turbine Blade Anisotropic Material Under Laser Cutting for the Reuse Context</strong>&lt;br&gt;<strong>Presenter:</strong> Larissa Mendes Hermógenes Rocha, Federal University of Paraíba, Brazil</td>
<td></td>
<td><strong>Abstract:</strong> The reusing process of wind turbine blades demands machining operations, commonly performed with laser tools due to the inherently anisotropic nature of the fiber reinforced polymer (FRP). Therefore, it is essential to understand the heat transfer in anisotropic media to control the heat-affected zone (HAZ), established when the blade is cutted. This work aims to use the Multi-Point Flux Approximation (MPFA) method in the numerical solution of transient heat conduction problems in anisotropic media. This poses as an alternative to the traditional Two-Point Flux Approximation (TPFA), which has a wide range of applications however fails to generate accurate solutions to problems with certain anisotropic materials configurations. Notwithstanding that the MPFA method is well-known, the transient version developed here is still unexplored in literature. The results observed with classical benchmark problems show that MPFA can describe the solutions of transient anisotropic problems more accurately than the traditional TPFA.</td>
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| CE003 | 3:15 pm-3:30 pm | Title: Grease Contamination Detection in the Rolling Element Bearing using Deep Learning Technique  
Presenter: Prashant Kumar Sahu, Indian Institute of Technology Kharagpur, India  

**Abstract:** Vibration Analysis is one of the most effective methods used for the condition monitoring of rolling element bearings. The early failure of bearing is mainly due to the presence of solid particles in the grease lubricants. The condition of lubrication in the bearing is an essential parameter to meet the various demanding conditions of the system. This paper aims to analyze the effect of lubricant contamination by solid particles on the dynamic behavior of rolling bearing and to classify them using a support vector machine (SVM) and deep learning algorithm. Experimental tests have been performed with 50 and 100 mg of sand dust particles added to the ball bearings to contaminate the grease lubricant at full load conditions. Vibration signals were analyzed in terms of RMS, kurtosis, skewness, and peak to peak for fault type classification using SVM. In deep learning, the raw vibration signals are converted into a spectrogram image and fed to convolution neural networks (CNN) for fault classification. The results indicate that both SVM and deep learning techniques are effective for fault classification under the influence of lubricant contamination. |
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| CE521 | 3:30 pm-3:45 pm | Title: Assessment of Binary and Ternary Biofuel Mixtures on the Performance and Emissions of a Common-rail Diesel Engine  
Presenter: Joaquim da Costa, University of Minho, Portugal  

**Abstract:** Biofuels used as additives for Diesel engine are proposed to diversify fuel sources and reduce greenhouse gas (GHG) emissions, but also to optimize engine performance, as well as to reduce pollutant emissions. In addition, when these biofuels are produced from low-grade wastes, they consume their energy and solve an environmental problem which is the disposal of hazardous wastes. In this study, pyro diesel (obtained from the pyrolysis of low-grade bio-oils wastes), biodiesel
and ethanol were evaluated as additives for diesel, in a series of tests performed on a common-rail Diesel engine. Binary fuel mixtures of pyro-diesel+diesel, biodiesel+diesel and ethanol+diesel with biofuel incorporation between 5% (w/w) and 10% (w/w) were evaluated and compared with ternary fuel mixtures of pyro-diesel+ethanol+diesel and biodiesel+ethanol+diesel with biofuel incorporation of 5% (w/w). The fuel mix performance was assessed by determination of brake torque and power; fuel consumption and efficiency, as well as engine emissions (HC, NOx, and smoke). Part-load torque (50 and 70 N.m and wide-open throttle - WOT) with constant 0.5 bar turbocharging pressure were tested at two different engine speeds (1800 and 2250 rpm). The additives incorporation up to 10% tended to improve combustion efficiency and reduce emissions such as HC, NOx, and opacity relatively to straight diesel.

Title: Proposal for Implementation of Induction Stoves for Electrification of The Peruvian Energy Matrix
Presenter: Dennis Raul Garay Aquino, Universidad Continental, Peru

Abstract: The objective of this research was to estimate the percentage of electrification of the Peruvian Energy Matrix. It based on the intention for change of an LPG user. The chosen of use induction stoves instead of gas stoves were based on the five fundamental aspects of the efficient energy transition: affordability, competitiveness, efficiency, environmental sustainability, and safety, and not for dogmatism or chosen by a committee. The results showed that the induction cookstove, based on the selection criteria of the best cooking technology, is the most affordable, competitive, efficient, clean and safe in Peru. Also, using electricity for cooking, with special rate, will allow the residential user to have 44% of economic savings compared to a 10kg LPG cylinder. In this way, according to the calculations done in this investigation, the Peruvian Energy Matrix (final consumption) will have 28% of electrification level (use of electricity) and the rate of electrification of end - use in buildings will be 77%.
Abstract: Solar energy is the most famous renewable energy resource among the other types; it is clean, environmentally friendly, and easy to integrate with other systems. Using the photovoltaic cells (PV), solar energy is obtained by conversing light from the sun to electricity. The solar energy market has become more attractive to so many different countries worldwide. However, solar energy is directly related to weather conditions, and thus, the amount of energy can not be definitely predicted. This disadvantage of solar energy impacts the power quality and the efficiency of the power grid. The current challenge is to incorporate solar energy with an effective, cost-efficient, long life cycle, and eco-friendly batteries. This thesis is about a techno-economic assessment of three different photovoltaic cell – battery system integration; PV-Lead-acid battery system, PV-NMC battery system, and PV-NMC Thick battery system. The classical NMC and Optimized NMC (NMC Thick) battery data and prices are different. The NMC thick is a result of three different methods done; the elimination of toxic, costly N-methyl pyrrolidone (NMP) dispersion chemistry; doubling the thicknesses of the anode and cathode to raise energy density; and the reduction of the anode electrolyte wetting and SEI-layer formation time. (David.L et al., 2014) These designs were proposed and investigated based on combinations of PV, battery energy storage, and converters. HOMER (Hybrid Optimization of Multiple Energy Resources) software is used for the optimization methodology; the data was collected for Cihannüma, Barbaros avenue. No:18, 34353 Beşiktaş/Istanbul, Turkey. It is found that the PV-NMC Thick system has a lower net present cost ($84,783) than the PV-NMC system ($95,805). The CAPEX of the PV-NMC Thick system is $62,645 and $70,840 for the PV-NMC system. The OPEX of the PV-NMC Thick system is $1,712 and $1,931 for the PV-NMC system. Furthermore, the LCOE of the PV-NMC Thick system is $1,60 and $1,81 for the PV-NMC system. In a nutshell, increasing the electrode thickness of the NMC battery has a positive impact on both the technical side; the battery storage wear cost is 0.675 $/kWh while for the NMC battery is 0.915$/kWh. And on the economic side by decreasing the PV-BESS system’s cost by around 11 percent. The price of the NMC batteries is predicted to decrease in the near future. Therefore, the main focus for future research and investment will be on the NMC battery types and their integration with the PV systems. Furthermore, for system optimization, new system designs should be developed to lower the battery’s cost and increase efficiency and battery operation life.
**Title:** Modeling Sand Particulate Flows Through Angled Apertures and Surfaces in Concentrated Solar-Thermal Power Receivers  
**Presenter:** Akarsh Aurora, Ashland High School, USA

**Abstract:** Concentrated solar-thermal power towers are increasingly migrating towards sand-based particle receiver designs to improve thermal efficiency in order to reach temperatures above 1000°C for air Brayton power cycles and supercritical CO₂ power cycles affordably. However, utilizing sand affords complexities in modeling particle flow characteristics due to variable geometric shape, size, and composition. Thus, the objective of this study is to model the particle flow characteristics of sand through variable angled chevron-shapes and receiver hoppers to help formulate robust modeling for flow dynamics. Treating the chevrons as an array of apertures, a novel method of calculating sand particle mass flow rate across angled apertures and surfaces is developed. Employing high-speed photography and particle imaging velocimetry techniques, our results incorporate the impact of effective angles upon velocity, residence time, and breakage profiles of falling sand particles. We determined a Beverloo equation incorporating effective angles for velocity and aperture size effective predicts mass flow rate through chevrons, which can serve as a reference for future particulate flow modeling in this field. In addition, increasing hopper angle and chevron tip angles resulted in higher particle diameter decrease after sand flow trials.
THANK YOU!