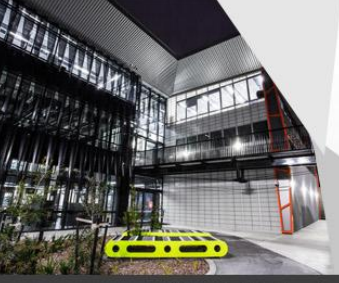

2019 International Conference on Smart Power & Internet Energy Systems (SPIES 2019)

April 25-27, 2019

SCHOOL OF ENGINEERING, DEAKIN UNIVERSITY, AUSTRALIA

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Welcome Message from the Conference General Chair

On behalf of the International Conference on Smart Power & Internet Energy Systems, **SPIES 2019** Organizing Committee, it is my immense pleasure to welcome to all delegates, keynotes speakers, sponsors, industry delegates and all participants. It is a great honor and pleasure to host SPIES 2019 at Deakin University at our Geelong Waurn Ponds Campus.

Geelong is a city southwest of Melbourne, Australia. Lining its bay, the Waterfront esplanade has a 19th-century carousel, plus a curved art deco boardwalk and sea bath at Eastern Beach. Scattered along the Waterfront are the Baywalk Bollards, colourful sculptures chronicling city history. The Geelong Botanic Gardens lie at the eastern end of the bay. The central National Wool Museum hosts changing exhibitions. I hope you will enjoy this beautiful city. SPIES is now a regular annual event which will rotate within countries in Asia and Europe.

It has been slightly more than 1 year, since this journey began once we agreed on to launch a new conference to discuss the emerging challenges and opportunities in power and energy systems. I would like to take this opportunity to express our sincere gratitude to all the supporters. This event was technically co-sponsored by Deakin University, Curtin University and University of Western Australia. I also would like to thank our sponsors to support the event.

The SPIES'2019 Organizing Committee wishes you a very successful conference, we have a number of key note addresses along with many technical presentations. We hope you will keep many fond memories from your participation in this conference.

Prof. Aman Oo
Head of the School, School of Engineering
Faculty of Science Engineering & Built Environment
Deakin University, Australia

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Tyrone Fernando (Australia), Advisory Chair

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Welcome Message from the Conference General Chair

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Abdelghani Chahmi (Algeria)

Keynote Speeches

Keynote Speaker I

Prof. Grahame Holmes (IEEE Fellow)
RMIT University, Australia

Professor Holmes graduated from the University of Melbourne with a B. Eng. in 1974. He has a Master's degree from the same university in power systems engineering, and a PhD from Monash University in power converter modulation theory. He was a faculty member at Monash University for 26 years, where he established the Power Electronics Research Group in 1996 to support graduate students and research engineers working together on both pure and applied R&D projects.

The interests of the group include fundamental modulation theory, VSI current regulators, active filter systems, resonant converters, current source inverters, and multilevel converters. In 2002 he formed a commercial R&D company from this group, specialising in the development of tailored power electronic conversion systems for unusual applications. In 2010, Professor Holmes was appointed as Innovation Professor – Smart Energy Systems at RMIT University, where he is currently extending his research interests to work with industry and government in the area of Smart Grids and Smart Energy technologies.Professor Holmes has been a major contributor to the field of power electronics research for nearly 30 years. His primary research focus has been to investigate fundamental questions concerning the principles of modulation and closed loop control of switching power converters. He has published a major theoretical reference book on this subject, together with over 250 refereed journal and conference articles (11000+ citations). He is a Fellow of the IEEE, reviews papers for all major IEEE transactions in his area, and has been an active member of the Industrial Applications, Power Electronics Societies of the IEEE for over 25 years.

KEYNOTE SPEECH TITLE： Power Electronics and the Emerging Smart Grid

ABSTRACT: For most of the 20th century, electrical energy has been generated by high power rotating generators that supply customers through a network of high voltage transmission lines and lower voltage distribution feeders. However, as the world moves inexorably towards Distributed Generation of renewable electrical energy, present day power system technologies are finding it harder and harder to meet the requirements of this new paradigm. Their fundamental limitations are clear – conventional generation assumes the availability of large scale stored energy for a small number of large generators, and energy is always assumed to flow unidirectionally from generators to consumers. Neither construct matches well with Smart Grid concepts, and alternative operating approaches are clearly required!

One foundational technology of Distributed Generation is the Power Electronic Converter, which can rapidly and flexibly control electrical energy almost instantaneously on a moment by moment basis. Since the 1950's, PE converters have become mainstream technology for industry, accurately controlling rotating machines, precisely processing energy with minimum energy wastage, and supporting a myriad of other applications. More recently, as their power handling capacity continues to increase, they are becoming very attractive for distributed generation systems where they can manipulate electrical energy in ways that simply cannot be done using rotating machines. The challenge at present is to decide exactly what we want to do with this capability.

This presentation will explore why power electronic converters are so flexible and attractive for Distributed Generation systems. It will firstly reflect on how the fundamental properties of these systems make them so versatile, and then will proceed to show how these properties particularly suit Distributed Generation needs and requirements. Finally, the current challenges of large scale usage of power electronic converters in electrical grid systems will be considered, looking at both technical challenges that are still to be overcome, and the operational control challenges that are still in the early stages of development.

Keynote Speeches

Keynote Speaker II

Prof. Innocent Kamwa (IEEE Fellow)
Hydro-Quebec Research Institute (IREQ), Canada

Innocent Kamwa obtained his B.S. and Ph.D. degrees in Electrical Engineering from Laval University, Québec City in 1985 and 1989 respectively. He has been a research scientist and registered professional engineer at Hydro-Quebec Research Institute since 1988, specializing in system dynamics, power grid control and electric machines. After leading System Automation and Control R&D program for years he became Chief scientist for smart grid, Head of Power System and Mathematics, and Acting Scientific Director of IREQ in 2016.

He currently heads the Power Systems Simulation and Evolution Division, overseeing the Hydro-Quebec Network Simulation Centre known worldwide. An Adjunct professor at Laval University and McGill University, Dr. Kamwa's Honors include four IEEE Power Engineering best paper prize awards, three IEEE Power Engineering outstanding working group awards, a 2013 IEEE Power Engineering Society Distinguished Service Award, Fellow of IEEE in 2005 for "innovations in power grid control" and Fellow of the Canadian Academy of Engineering. He is also the 2019 Recipient of the IEEE Charles Proteus Steinmetz Award.

KEYNOTE SPEECH TITLE：Advanced Synchrophasors Data Analytics for Control and Dynamic Stability Monitoring in Smart Grids

ABSTRACT: The speaker discusses a comprehensive framework for phasor analytics deemed necessary to enable advanced wide-area control and monitoring applications in smart grids. The key component in this building is the smart PMU for control (PMU/C) which from the substation can feed accurate fundamental and low order harmonics phasors to the phasor data concentrator at a higher than the standard rate of one point per cycle. The second piece of the building is the dynamic generator state estimation, which is mandatory to enhance the observability of dynamic phenomena and thus, improves control performance and protection dependability. Following dynamic state estimation, a combined time and frequency domain processing of voltage, angle and frequency measurements based on S-transform is proposed as a good mean for extracting critical features which enable crisper information that are more easily interpretable than the raw phasor time-series. Gluing all the proposed pieces at both substation and supervisory levels, it is possible to build a smart Wide-Area Situational Awareness (WASA) System, able to close the loop through educated and well informed operators for handling GMD impacts on the grid and/or through fast control and automation devices for dealing with stability issues. The speaker illustrates some salient features of the proposed WASA framework drawing from smart grid applications recently developed in the real-time simulation laboratory of Hydro-Quebec Research Institute.

Keynote Speeches

Keynote Speaker III

Mr.Jean Bélanger
President of OPAL-RT TECHNOLOGIES, Montreal, Canada

Jean Bélanger is the co-founder, CEO and CTO of OPAL-RT TECHNOLOGIES. Founded in 1997, OPAL-RT develops and commercializes one of fastest and most advanced digital real-time simulators for system design and electronic controller testing. Jean Bélanger received his Electrical Engineering degree in 1971 at Laval University, in Quebec City, and his Master's degree from the École Polytechnique in Montreal.

Under his direction and technological leadership, OPAL-RT has become a well-known developer of state-of-the-art real-time simulators capable of simulating all types of mechanical and electrical systems, including the fastest power electronic converters used in a wide range of industries - from hybrid vehicles to entirely electrical-driven aircraft, and from micro-grids to very large AC/DC power systems. Jean Bélanger began his career at Hydro-Quebec's System Planning Division for the design of several aspects of the James Bay 735-kV transmission systems. He also worked at the IREQ where he contributed to the design and construction of Hydro-Quebec real-time simulators.Today, Jean Bélanger foresees that high-end real-time simulators will soon be available to all engineers, scientists and students by taking full advantage of off-the-shelf PCs. This is the driving challenge that Jean Bélanger and the OPAL-RT team have taken as their primary goal.

KEYNOTE SPEECH TITLE：Power Systems Evolutions and Challenges for Specialists, Utilities and Simulation Tool Suppliers

ABSTRACT: In the last half-century, we have witnessed wholesale and essential changes in the ways we structure and conceive of generation, transmission and distribution systems.

• Generation systems have evolved from high-inertia, schedulable, large rotating machines to low-inertia, power-electronics-based, small and distributed non schedulable renewable energy systems;

• Transmission systems have evolved from traditional AC transmission circuits and local protection systems to AC-DC transmission networks equipped with fast power electronics controllers (FACTS). Sophisticated wide-area protection and control schemes and communication systems are both used to maximize security, and power transfer capability to reduce rights-of-way;

• Distribution systems can no longer be represented by simple passive and dynamic load equivalents. Distributed energy generation and storage systems may now be integrated anywhere on the grid, including at customer sites. Each customer can potentially become a de-centralized 'prosumer' of sorts, with photovoltaics (PVs), batteries, and plug-in electrical vehicles.

Generation, transmission and distribution systems must therefore be viewed as integrated and intelligent power grids in which each subsystem can be operated synchronously or asynchronously with the main grid—or, alternately, as completely disconnected in case of problems based on local control and protection systems. This level of semi-autonomy and complexity will only increase with the spread of automated energy exchange contracts between consumers--and further, between consumers and the main grids. New operational and automated trading rules may also be required to help broker increasingly vast numbers of energy transactions. The involvement of several sytem operators will undoubtedly also be required to help mediate these challenges. As an unavoidable consequence of the above, the sheer number of fast power electronics subsystems interacting both between themselves and with the main grids will then also increase dramatically. Voltage, as well as frequency control and generator/load balancing, will, in turn, also become exponentially more complex. (These intelligent systems are usually installed by third parties primarily concerned with the performance of their systems operating in stand-alone mode, and not so much about the interaction between other systems and the grid(s).

Keynote Speeches

Additionally, it may not be assumed that utilities are necessarily controlling the quality of the dynamic models required to evaluate the behavior of these systems under abnormal and fault conditions. Consequently the impact on global grid performance and security could end up becoming problematic.) International standards committees are still working on these challenges to ensure that control and energy systems will eventually lead to reliable energy delivery systems. This presentation will discuss the expected flexibility and capability of simulation tools and “digital twins” that will be required to cope with the increasing complexity of our shared modern and evolving intelligent distributed power grids.

Keynote Speeches

Keynote Speaker IV

Prof. Mohamed El Hachemi Benbouzid
University of Brest, France

Mohamed Benbouzid received the B.Sc. degree in electrical engineering from the University of Batna, Batna, Algeria, in 1990, the M.Sc. and Ph.D. degrees in electrical and computer engineering from the National Polytechnic Institute of Grenoble, Grenoble, France, in 1991 and 1994, respectively, and the Habilitation à Diriger des Recherches degree from the University of Picardie "Jules Verne," Amiens, France, in 2000.

After receiving the Ph.D. degree, he joined the Professional Institute of Amiens, University of Picardie "Jules Verne," where he was an Associate Professor of electrical and computer engineering. Since September 2004, he has been with the Institut Universitaire de Technologie of Brest, University of Brest, Brest, France, where he is a Professor of electrical engineering. Prof. Benbouzid is also a Distinguished Professor at the Shanghai Maritime University, Shanghai, China. His main research interests and experience include analysis, design, and control of electric machines, variable-speed drives for traction, propulsion, and renewable energy applications, and fault diagnosis of electric machines. Prof. Benbouzid is an IEEE Senior Member. He is the Editor-in-Chief of the International Journal on Energy Conversion(IRECON). He is also an Associate Editor of the IEEE Transactions on Energy Conversion, the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Sustainable Energy, the IEEE Transactions on Vehicular Technology. He is a Subject Editor for the IET Renewable Power Generation.

KEYNOTE SPEECH TITLE：On Electric and Hybrid Vehicles Optimal and Fault-Tolerant Control: Issues, Solutions, and Recommendations

ABSTRACT: In a world where environment protection and energy conservation are growing concerns, the development of electric and hybrid vehicles has taken on an accelerated pace. Electricity is gaining more importance in critical applications such as transportation (with more electric aircraft, electric ships, and electric vehicles), where continuity of operation is crucial, and there is a growing demand for safety, reliability, maintainability, and survivability. However, several failures afflict electrical machines, sensors, the wiring network (carrying power and/or communication signals), and power converters. To ensure the required levels of reliability and availability in transportation, efficient methods for fault resilience are mandatory. This has drawn significant research in the design of resilient or fault-tolerant systems, namely systems, which are designed to tolerate some faults or able to promptly adapt the control law (fault-tolerant control) in such a way as to preserve pre-specified satisfactory performances in terms of production quality, safety, etc. The need for these resilient or fault-tolerant systems has inspired much research for the particular case of electric machines drives. The majority of these contributions have been focused on faults in the machine or the drive components while current trends include sensors and application fault modes. High resilience can indeed be achieved with robust or oversized systems but the industrial tendency, in particular for transportation applications, which are characterized by high survivability requirements such naval systems, is to design fault-tolerant power conversion systems. These systems include redundancy by adopting specific machines and drive configurations such as multiphase or multi-windings/multi-converters systems. In this challenging context, this keynote aims to present first the fault-tolerant control foundations: Resilient control (also known as accommodation); reconfiguration; and hardware and analytical redundancy. It will be followed by a critical state of the art review focused on electric and hybrid systems, from land to naval propulsions, detailing the main issues and proposing solutions and recommendations.

Keynote Speeches

Keynote Speaker V

Prof. Tyrone Fernando
University of Western Australia, Australia

Tyrone Fernando obtained his bachelor of engineering with honours and the degree of doctor of philosophy from the University of Melbourne in 1990 and 1996 respectively. In 1996 he joined the University of Western Australia, Department of Electrical Electronic and Computer Engineering (EECE) where he is currently a Professor. He was the Deputy Head of School in 2009 and 2010.

His research interests are in power systems, renewable energy, estimation theory and its applications. He has served as an Associate Editor for IEEE Transactions on Information Technology in Biomedicine and also as guest editor for the journal of Optimal Control Applications and Methods. He has authored many journal and conference articles and also two books. Professor Fernando is a senior member of IEEE, current Chair Elect of the Power and Energy technical committee of the IEEE Circuits and Systems Society and serves as an Associate Editor for IEEE Transactions on Circuits and Systems II and IEEE Access. In 2019 he was received the Outstanding Engineer award by IEEE PES WA Chapter.

KEYNOTE SPEECH TITLE： Evolution of the Electric Grid

ABSTRACT: The centralised power generation, transmission and distribution electric grid that we currently have is over 100 years old. With the introduction of renewable energy for power generation and incorporation of advance metering technologies, latest control and communication techniques is transforming the electric grid to a more advanced state where consumers can participate in various ways to provide services to enhance the reliability of the power supply. This presentation will focus on the evolution of the electric grid and consumer participation in maintaining a stable power system through services such as demand response.

Keynote Speeches

Keynote Speaker VI

Prof. S. M. Muyeen
Curtin University, Australia

Dr. S. M. Muyeen received his B.Sc. Eng. Degree from Rajshahi University of Engineering and Technology (RUET), Bangladesh formerly known as Rajshahi Institute of Technology, in 2000 and M. Eng. and Ph.D. Degrees from Kitami Institute of Technology, Japan, in 2005 and 2008, respectively, all in Electrical and Electronic Engineering. At the present, he is working as an Associate Professor in the Electrical and Computer Engineering Department at Curtin University, Perth, Australia.

His research interests are Renewable Energy, Energy Storage System, Smart Grid, and Power System Stability. He is the author/co-author of about 200 scientific articles including 80+ journals. He has also authored/edited 6 Books as an author/editor in the area of wind energy, electrical machines, and smart grid. He is serving as Editor/Associate Editor for many prestigious Journals from IEEE, IET, and other publishers, e.g., IEEE Transactions of Sustainable Energy, IEEE Power Engineering Letters, and IET Generation, Transmission & Distribution, etc. He is the subject editor for IET Renewable Power Generation and also served as the Guest Editor-in-Chief/Leading Guest Editor/Guest Editor for special issues from IET Generations, Transmissions, and Distribution, Applied Sciences, and International Journal of Electrical Power & Energy Systems. He was the recipient of many prestigious awards including the Petroleum Institute Research/Scholarship Award 2012, which was the only research award for the entire university until 2013. He has received many best paper prizes from IEEE Conferences and also the recipient of IEEE Outstanding WA Engineer Award 2017 jointly from PES and PELS societies. He has secured many national and international research grants and have massive experience in developing research infrastructures for universities and research centers. Dr. Muyeen has given many Keynote and Invited speeches to International Conferences and renowned universities. Dr. Muyeen is the Senior Member of IEEE and Fellow of Engineers Australia (FIEAust).

KEYNOTE SPEECH TITLE：ICT Enabled Wide Area Control for Smart Grid

ABSTRACT: The power and energy sector is going through a fast transformation as energy sustainability, efficiency, reliability and environmental concerns are becoming major concerns in the twenty-first century. Distributed Generations are now emerging as standard features of today's complex power system. The interconnection of small scale modular generating units like PV, wind turbine, photovoltaic system, micro-turbine, fuel cells, and energy storage systems like battery, flywheel, supercapacitor, superconducting magnetic energy storage to the low voltage distribution network in ac, dc or hybrid form leads to a new energy system paradigm, known as Micro-grid. With the blessings of modern Information and Communication Technologies (ICT), Micro-grid is further going through another transformation, known as Smart grid. This talk presents ICT applications in smart grid focusing more in Wide Area Control (WAC) system to augment stability and reliability of traditional power system.

General Information

The Venue

Geelong sits at the start of one of the world's most beautiful coastal drives, the Great Ocean Road. Surf beaches, whale watching and the famous Twelve Apostles are on your doorstep. On campus there are heaps of outdoor areas and spacious new buildings, perfect for both socialising and studying. Waurn Ponds Campus has incredible sports facilities – from a stadium, sports hall and courts, to a deluxe health club, complete with gym, work-out studios and group fitness classes. Get the best of both worlds at our Geelong Waurn Ponds Campus. Access our world-class education programs and superb facilities while relaxing in a pretty, rural environment, close to some of Australia's best surf beaches.

Address: School of Engineering, Building KE, Geelong Waurn Ponds Campus, Deakin University, Geelong

Coffee breaks

Coffee breaks will be served daily in the morning and in the afternoon on the corridor outside the conference room.

Lunch

Lunch on the 26th provided will be served at the Natural 1 Coffee at 13:00p.m-13:50p.m.
(It's just across the road from building KE).
You are kindly requested to have your Lunch Coupons with you and present them to the waiters upon arrival at the Natural 1 Coffee. Lunch Coupons are provided in your registration packet by the Conference Secretariat.

Gala dinner

The Gala dinner will take place on Friday April 26th, 2019 at the Rydges Geelong（Hotel）. Dressing could be casual.
Please do not forget to bring your Dinner Tickets.

Best Presentation Award

Three papers awards will be presented during closing ceremony.

Dress code

Please wear formal clothes or national representative of clothing.

General Information

Paper presentation

In SPIES'2019 Proceedings, there will be no difference in between oral and poster presentations. All papers will be treated in the same way and will be available in the corresponding database after the conference only if presented.

Oral

All the authors presenting a paper in oral are kindly requested to proceed to the technical support desk 1 hour before the session schedule in order to download their presentation in the computer available in the room. They have to provide the co-chairs with a single PDF file of their presentation bring on a USB key. It is not possible to change of computer in between presentations. The length of the presentation is restricted to 15 minutes including questions. The authors presenting a paper are strongly advised to keep their oral presentation within 15 minutes (10 to 15 slides) and to let 3 minutes for questions. They have to verify that their bio has been printed in their final version otherwise they have to bring a short printed bio of 10 lines maximum to the session co-chairs.

Poster

A poster preparation is a difficult but rather interesting exercise. It is not allowed to simply pin up a simple copy of the published paper. The provided template has a A0 European size (119cm height, 84cm width). Please do remain strictly in these dimensions.
Each poster will be hanged by the presenters using material provided by conference organizers.

Internet access

A free internet wireless access will be provided to SPIES'2019 participants. Please do bring with you a laptop with Wi-Fi facilities.

Social Excursion

The Great Ocean Road is an Australian National Heritage listed 243-kilometre stretch of road along the south-eastern coast of Australia between the Victorian cities of Torquay and Warrnambool.

The road was built by returned soldiers between 1919 and 1932, and is the world's largest war memorial; dedicated to casualties of World War I.

It is an important tourist attraction in the region, which winds through varying terrain alongside the coast, and provides access to several prominent landmarks; including the nationally significant Twelve Apostles limestone stack formations.

The Great Ocean Road, officially starts at Torquay and travels 243 kilometres westward to finish at Allansford near Warrnambool, the largest city along the road. The road is two lane (one in each direction), with the majority covered by an 80 kilometre per hour speed limit.

Should you wish to attend please book your seat upon registration at the Conference Secretariat.

The City of Melbourne

Melbourne is the capital and most populous city of the Australian state of Victoria, and the second most populous city in Australia and Oceania. Its name refers to an urban agglomeration of 9,992.5 km2 comprising a metropolitan area with 31 municipalities, and is also the common name for its city center. The city occupies much of the coastline of Port Phillip bay and spreads into the hinterlands towards the Dandenong and Macedon ranges, Mornington Peninsula and Yarra Valley. It has a population of approximately 4.9 million (19% of the population of Australia), and its inhabitants are referred to as "Melburnians". The EIU currently ranks it the second most liveable city in the world.

Melbourne is an international cultural centre and the city serves as Australia's cultural capital, with prominent offerings in the form of major events and festivals, drama, musicals, comedy, music, art, architecture, literature, film and television. The climate, waterfront location and nightlife make it one of the most vibrant destinations in Australia. For seven years in a row (from 2011 to 2017) it held the top position in a survey by The Economist Intelligence Unit of the world's most liveable cities, partly due to its broad cultural offerings. The city celebrates a wide variety of annual cultural events and festivals of all types, including Australia's largest free community festival—Moomba, the Melbourne International Arts Festival, Melbourne International Film Festival, Melbourne International Comedy Festival and the Melbourne Fringe Festival. The culture of the city is an important drawcard for tourists, of which 2.7 million international and 8.9 million domestic travellers arrived in 2017.

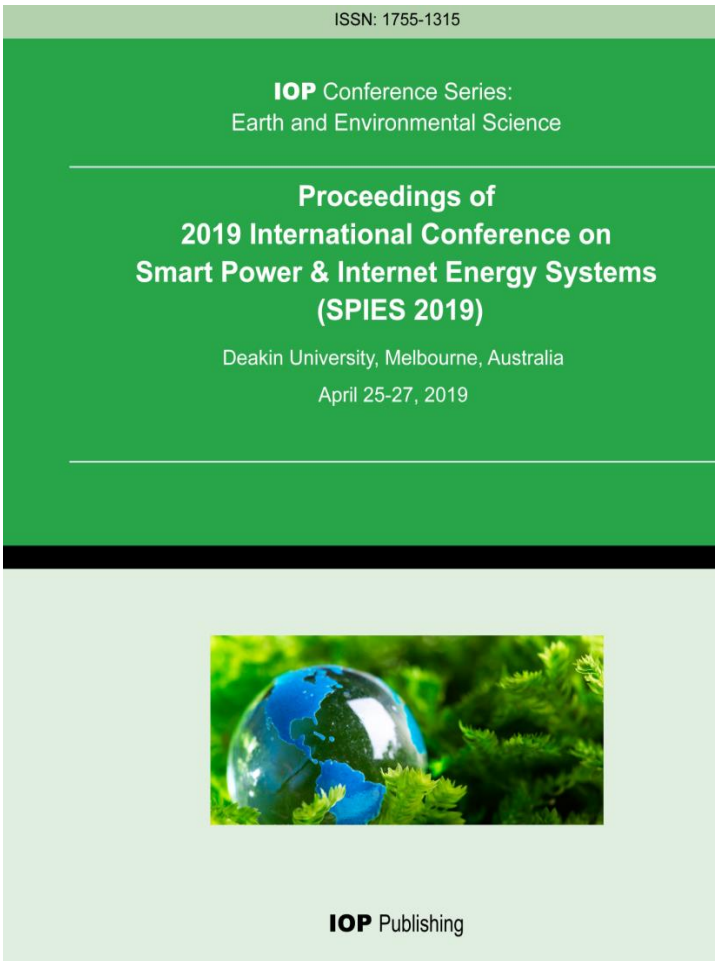
Known for its bars, street art and coffee culture, the inner city's network of laneways and arcades is a popular cultural attraction.

Melbourne's rich and diverse literary history was recognised in 2008 when Melbourne City of Literature became the second UNESCO City of Literature. The State Library of Victoria is one of Australia's oldest cultural institutions and one of many public and university libraries across the city. Melbourne also has Australia's widest range of bookstores, as well the nation's largest publishing sector. The city is home to significant writers' festivals, most notably the Melbourne Writers Festival. Several major literary prizes are open to local writers including the Melbourne Prize for Literature and the Victorian Premier's Literary Awards.

Conference Introductions

Welcome to 2019 SPIES Australia conference. This conference is meant for researchers from academia, industries and research & development organizations all over the globe interested in the areas of Smart Power & Internet Energy Systems, multimedia and computer graphics. It will put special emphasis on the participations of PhD students, Postdoctoral fellows and other young researchers from all over the world. It would be beneficial to bring together a group of experts from diverse fields to discuss recent progress and to share ideas on open questions. The conference will feature world-class keynote speakers in the main areas.

1. Most papers will be published in the IOP Conference Series: Earth and Environmental Science (EES) (ISSN: 1755-1315), which is indexed by EI Compendex, Scopus, Thomson Reuters (WoS), Inspec,et al.



Other major publications:
(Just for reference)

2. 'Technology and Economics of Smart Grids and Sustainable Energy' Journal from Springer, ISSN: 2199-4706 after a peer review process by journal.
Abstracted/Indexed in: INSPEC, Google Scholar, CNKI, INIS Atomindex, OCLC, ProQuest ABI/INFORM, ProQuest Agricultural & Environmental Science Database, ProQuest Business Premium Collection, ProQuest Central, ProQuest Materials Science & Engineering Database, ProQuest Natural Science Collection, ProQuest SciTech Premium Collection, ProQuest Technology Collection, Summon by ProQuest.
3. 'International Journal of Smart Grid and Clean Energy', (IJSGCE) ISSN: 2373-3594 after a peer review process by journal.
Abstracted/Indexed in: Scopus, EI (INSPEC, IET), EBSCO, Ulrich's Periodicals Directory, Google Scholar, Crossref, etc.
4. Energies' Journal, Special Issue, Impact Factor – 2.676, ISSN 1996-1073; CODEN: ENERGA, after a peer review process by the Journal with a 25% discount on publication cost.

Abstracted/Indexed in: Web of Science (Clarivate Analytics), Scopus (Elsevier), Science Citation Index Expanded - Web of Science (Clarivate Analytics), Journal Citation Reports / Science Edition (Clarivate Analytics, formerly Thomson Reuters' IP & Science branch), Ei Compendex / Engineering Village, AGORA (FAO) - Agricultural Sciences and Technology (FAO), Inspec (IET), IDEAS (RePEc), Norwegian Register for Scientific Journals, Series and Publishers (NSD), and others

Conference website and email：http://www.icspies.org and *spies.conference@gmail.com*

SPIES 2019 PROGRAM-AT-A-GLANCE

Time	Thursday, 25th April
10:00 -17:00	Registration Day（Location – Ante Room(The first floor), Rydges Hotel, Geelong ） **Participants Onsite Registration & Conference Materials Collection**
Time	**Friday, 26th April**
8:00 - 9:00	Registration
9:00 - 9:10	**Opening Remark (**Location - Ke1.207 Room -School of Engineering Building)
9:10 - 9:45	Keynote I - **"Power Electronics and the Emerging Smart Grid"** by ***Prof. Grahame Holmes*** (Location - Ke1.207)
9:45 - 10:20	Keynote II - **"Advanced Synchrophasors Data Analytics for Control and Dynamic Stability Monitoring in Smart Grids"** by ***Prof. Innocent Kamwa*** (Location - Ke1.207 Room)
10:20 - 10:55	Keynote III - **"Power Systems Evolutions and Challenges for Specialists, Utilities and Simulation Tool Suppliers"** by ***Mr.Jean Bélanger*** (Location - Ke1.207 Room)
10:55 - 11:15	**Coffee Break & Group Photo Taking** (Location – the corridor outside the conference room Ke1.207)
11:15 - 11:50	Keynote IV - **"On Electric and Hybrid Vehicles Optimal and Fault-Tolerant Control: Issues, Solutions, and Recommendations"** by ***Prof. Mohamed El Hachemi Benbouzid*** (Location - Ke1.207 Room)
11:50 - 12:25	Keynote V - **"Evolution of the electric grid"** by ***Prof. Tyrone Fernando*** (Location - Ke1.207 Room)
12:25 - 13:00	Keynote VI - **"ICT enabled Wide Area Control for Smart Grid"** by ***Prof. S. M. Muyeen*** (Location - Ke1.207 Room)
13:00 - 13:50	Lunch Time (Location – Natural 1 Coffee)* Natural 1 Coffee（It's just across the road from building KE）
13:50 - 15:20	Session 1 **"Renewable Energy"** Session Chair: Prof. Hieu Trinh (Location - Ke1.207 Room)
	Session 2 **"Distributed Generations and Microgrid"** Session Chair: Dr. Enamul Haque (Location - Ke2.202 Room)
	Session 3 **"Power System Dynamics and Protection"** Session Chair: Dr. Apel Mahmud (Location - Ke1.104 Room)
15:20 - 15:40	**Tea Break** (Location – the corridor outside the conference room Ke1.207)
15:40 - 17:10	Session 4 **"Smart Building, Smart Cities and SmartGrid"** Session Chair: Dr. Mohammad Arif (Location - Ke1.207 Room)
	Session 5 **"Power Electronics and Energy Conversion"** Session Chair: Dr. Sajeeb Saha (Location - Ke2.202 Room)
	Session 6 **"Control, Automation, and Energy Harvesting"** Session Chair：Prof. Tyrone Fernando (Location - Ke1.104 Room)
17:10 - 17:40	**Closing Ceremony**
19:00 - 21:00	**Gala Dinner** (Location - Terrace room, the first floor, Rydges Hotel, Geelong)

Session No.	Session Titles	Location	Chairs
SP01	Renewable Energy	Ke1.207 Room	Prof. Hieu Trinh
SP02	Distributed Generations and Microgrid	Ke2.202 Room	Dr. Enamul Haque
SP03	Power System Dynamics and Protection	Ke1.104 Room	Dr. Apel Mahmud
SP04	Smart Building, Smart Cities and Smart Grid	Ke1.207 Room	Dr. Mohammad Arif
SP05	Power Electronics and Energy Conversion	Ke2.202 Room	Dr. Sajeeb Saha
SP06	Control, Automation, and Energy Harvesting	Ke1.104 Room	Prof. Tyrone Fernando

Time	Saturday, 27th April
10:00 -17:00	**Academic Visit & Technical Discussion (Location – Deakin University)** (The specific schedule is subject to the actual arrangement)

Session Summary

Session 1 Renewable Energy

Session 2 Distributed Generations and Microgrid

Session 3 Power System Dynamics and Protection

Session 4 Smart Building, Smart Cities and Smart Grid

Session 5 Power Electronics and Energy Conversion

Session 6 Control, Automation, and Energy Harvesting

Paper Details

Session 1

Oral Presentation Abstracts

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 13:50~15:20
Venue: Ke1.207 Room

Topic: "Renewable Energy"

Session Chair: Prof. Hieu Trinh

SS0009 Presentation 1 (13:50~14:05)

Study of the Dynamic Matrix Control of the Cascaded Phase Change Energy StorageSystem for Wind Power Regulation

Sanli Zhu[1] , Jiping Lu[2] and Qian He[3]
1, Chongqing University, Chongqing, China
2, Chongqing University, Chongqing, China
3, State Grid Chongqing Electric Power company, Chongqing, China

Abstract — A modified cascaded phase-change energy storage system (CPESS) consisting of the heat accumulator and the steam-driven double-screw generator (SDG) is proposed in this paper to accommodate the wind fluctuations. The dynamic matrix control (DMC) algorithm is applied to improve the operating performance of the cascaded SDGs. Firstly, the predictive model of the SDGs under the rated working condition is established based on its step response. Secondly, the reference track of each SDG is pre-planned according to the present difference value of the wind farm output and the load demand. Thirdly, the predictive model of each SDG and the input control series of the SDGs are continually adjusted by means of rolling optimization combined with feedback correction until the output of the CPESS approximates its expectation during the DMC process. Case studies show that the transfer error and the time-lag accumulation of the SDGs are restrained and the CPESS responds relatively faster with a higher energy efficiency. The proposed predictive control strategy is applicable for other similar cascaded time-lag systems.

SS0057 Presentation 2 (14:05~14:20)

Experimental Modelling of Grid Tied Thermoelectric Generator from Incinerator Waste Heat

Miftah Y. Fauzan[1], S.M. Muyeen[1], Syed Islam[2]
1, Department of Electrical Engineering, Curtin University, Australia
2, School of Science Engineering and Information Technology, Federation University, Australia

Abstract — This paper presents an experimental investigation of nano power generation, less than 1 kW size, using Thermoelectric Generator (TEG). The heat source is expected from the waste temperature of the incinerator, but in the laboratory experiment, it was from an electric heat source controlled by the electronics device. A prototype of 0.02 kW system, comprising 24 modules of TEG bismuth telluride type connected in series, was built. The system is attached to cooling and temperature controller to investigate the characteristics. Preliminary experiments and analytical models of electric output power as function of specific temperature were presented. An optimum output power could be set at a certain condition.

Paper Details

Session 1
Topic: "Renewable Energy"
Session Chair: Prof. Hieu Trinh

SS3005 Presentation 3 (14:20~14:35)

Grid-interactive Rooftop Photovoltaic Clusters with Third-party Ownership

Kumudu N. Amarawardhana[1], **Shantha D. G. Jayasinghe[2]** and Farhad Shahnia[3]
1, Department of Mechanical Engineering, General Sir John Kotelawala Defence University, Colombo, Sri Lanka
2, College of Sciences and Engineering, Australian Maritime College, University of Tasmania, Newnham, Australia
3, Discipline of Engineering and Energy, Murdoch University, Perth, Australia

Abstract — Irrespective of having a variety of policies and competitively lower costs of solar panels, rooftop photovoltaic (PV) systems have not been attractive to the majority of stakeholders because a perfect integration of the technologies and policies is yet to evolve. In this context, the power purchasing agreement (PPA) scheme under third-party ownership is becoming an attractive financing option available for residential PV applications. This paper elaborates on an innovative concept for the development of a centralized unit commitment management system for grid-interactive rooftop PV systems that are integrated with energy storage systems, under a PPA scheme. It is technically feasible to expand the energy storage of distributed PV systems and link together to operate as a cluster, where there is a huge potential in achieving number of grid supporting operations including peak shaving and load shifting. This paper emphasizes that economic feasibility of the proposed concept depends on the accuracy of demand prediction and smart monitoring of system parameters and thus, an artificial intelligence (AI)-based monitoring approaches, which have a greater potential in real-time handling of operations, are required to achieve the best results. The implementation of this concept will be beneficial for almost all stakeholders involved in the business-as-usual and simultaneously, act as a catalyst in popularizing PV systems in developing countries.

SS0012 Presentation 4 (14:35~14:50)

Operational Cost Reduction of PV-PHS Systems in Farmhouses: Modelling, Design, and Experimental Validation

Navid Mousavi, Ganesh Kothapalli, Daryoush Habibi, and Choton K. Das
School of Engineering, Edith Cowan University, Joondalup, WA 6027, Australia

Abstract — This paper proposes a PV-PHS system designed for farmhouses to reduce electricity costs. This study uses existing irrigation systems to store surplus energy coming from PVs in the form of gravitation potential energy. The storage is a type of pumped hydro storage (PHS) system using a water well as the lower reservoir. A comprehensive PHS model is presented and tested with the experiment setup to accurately estimate the stored water. An energy management system (EMS) is designed to manage the stored water to reduce electricity costs without disturbing irrigation functionality. The proposed system is tested in an experimental setup to validate the performance of the system. Then the PV-PHS system is simulated in MATLAB to show the results with a high efficiency pump and turbine. The proposed PHS system reduced the operational cost of the farmhouse by 71.5%.

Paper Details

Session 1
Topic: "Renewable Energy"
Session Chair: Prof. Hieu Trinh

SS0025 Presentation 5 (14:50~15:05)

An Advanced Incremental Conductance MPPT Technique Considering Time-varying Solar Irradiances

Lijun Zhang, Samson Shenglong Yu, Tat Kei Chau, Tyrone Fernando and Herbert Ho-Ching Iu
Department of Electrical, Electronic and Computer Engineering,
University of Western Australia, Perth, Australia

Abstract —For most of Maximum Power Point (MPP) Tracking (MPPT) techniques, their design principle are based only on output characteristics of photovoltaic (PV) panel under steady state, i.e., under constant solar irradiance. Because this steady state output characteristics do not describe how the operating point moves between different I-V curves under dynamic state, i.e., under varying solar irradiance, it inevitably results in poor dynamic performances or wrong perturbations. Focusing on this issue, in this paper, we propose the concepts of output characteristics of PV system which consist of two parts: output characteristics of PV system under steady state and output characteristics of PV system under dynamic state. Building on the output characteristics of PV system under two states, the widely used Incremental Conductance (Inc.Cond) technique is modified. Through simulation studies and the conventional Inc.Cond technique, the proposed advanced Inc.Cond technique retains good performances under steady state; under dynamic operation states, the MPPT performances are significantly improved.

SS0022 Presentation 6 (15:05~15:20)

Wind Speed Forecasting Using First Order Markov Transition With Regime Switch and Time Duration

Ahmed Abubakar Elwan, H M Habibuddin
Universiti Teknologi Malaysia, Johor, Malaysia

Abstract — Due to the dynamic nature of time series, it is common to deploy varying models in predicting behavior of the inherent characteristics in time series. The growing need in nonlinear series prediction and the limitations of linear models in predicting the behaviors of such, lead to the quest of models capable of predicting both dynamic and non-linear behaviors in time series. Markov Regime switching model commonly referred to as the regime switching model is used to forecast wind speed taking into account variation of speed with time. Eviews, a statistical, econometric and economic modelling package is used for the Markov regime switch estimation, simulation and forecasting of A 24-hour period real wind speed data measurement from NREL. Values obtained from forecast accuracy evaluation are Root Mean Squared Error (RMSE) is at 0.242, the Mean Absolute Error (MAE) is 0.17 and the Mean Absolute Percentage Error (MAPE) is 31.38. The statistics showed that the forecast is closely related to the actual values.

Paper Details

Session 2

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 13:50~15:20
Venue: **Ke2.202 Room**

Topic: "Distributed Generations and Microgrid"

Session Chair: Dr. Enamul Haque

SS0007 Presentation 7 (13:50~14:05)

An Energy Management System for Hybrid Energy Sources-based Stand-alone Marine Microgrid

Muhammad Fahad Zia, Elhoussin Elbouchikhi and **Mohamed Benbouzid**
1 University of Brest, UMR CNRS 6027 IRDL, Brest, France
2 ISEN Yncr éa Ouest, UMR CNRS 6027 IRDL, Brest, France
3 Shanghai Martime University, Shanghai, China

Abstract — Microgrids are becoming a viable solution for satisfying energy demand of rural and remote areas. Indeed, energy demand of islands can be met by renewable energy sources, energy storage systems, and micro-conventional generation sources-based microgrid systems. The optimal scheduling of these energy sources requires an energy management system for microgrids. Bretagne region in France has huge potential in marine renewable energy sources. Therefore, islands in this region can use tidal turbines with other energy sources to meet their local energy consumption. A case study of stand-alone marine microgrid system for Ouessant island is proposed in this paper. The considered microgrid includes PV system, tidal turbine, diesel generator, and Li-ion battery. The architecture and optimal scheduling of the developed microgrid system is presented to reduce operating and maintenance costs. The developed energy management architecture can help microgrid systems planning for islands in the near future.

SS0015 Presentation 8 (14:05~14:20)

A 3P4SW Based UPQC to Improve Power Quality in Medium Voltage Distribution System

Senthil Vadivu U and **Keshavan Belur Kuppannaiyengar**
PES University, Bangalore, India

Abstract — The adverse effect of power quality issues on power distribution system due to power electronics based controllers has tremendously increased in the modern power system; therfore, it is highly desired to design a novel power quality conditioner with a minimum number of switches to compensate voltage and current distortions. This proposed configuration reduces switching losses and also effectively alleviates the performance of the power quality conditioner. This paper introduces a configuration of 3P4SW (Three Phase Four Switch) UPQC (Unified Power Quality Conditioner) for both shunt and series APF (Active Power Filter) which can be implemented in medium voltage power grid. The major challenge of phase balance with only four switches in UPQC is accomplished by adaptive Self-tuning PID using neuro-fuzzy logic control and adaptive reference current generation scheme. This controller improves sag and swells compensation with better angle control via shunt and series converter performance and passive components design. The efficacy of proposed topology is tested on MATLAB/Simulink software and results are compared with the existing three phase six switch configuration (3P6SW).

Paper Details

Session 2
Topic: "Distributed Generations and Microgrid"
Session Chair: Dr. Enamul Haque

SS0038 Presentation 9 (14:20~14:35)

Co-ordinated Frequency Droop-based Power Sharing Strategy of Resilient Networked Microgrids Through DC Grid

Mir Nahidul Ambia[1], Ke Meng[2], Weidong Xiao[3], and Zhao Yang Dong[4]
1, University of Sydney, NSW, Australia
2, UNSW, NSW, Australia
3, University of Sydney, NSW, Australia
4, UNSW, NSW, Australia

Abstract — The paper presents a networked microgrid system, where droop-based frequency regulation has been implemented on PQ control of inverters. During transition from grid mode to islanding mode, the networked microgrid faces extreme disturbances, which requires proper sharing within the network. In this paper, a networked microgrid topology is analysed, where power sharing occurs through the dc network. Moreover, proposed controller activates a droop sharing strategy, which identifies required active power for frequency regulation before entering to islanding stages. However, during power sharing case, microgrid capable of extracting additional power uses the droop control, while other network inverter utilizes dc link voltage, resulting calculation of overall reference inverter current for proper sharing. Furthermore, the controller co-ordinates between different microgrids based on the reference current to enhance the resilience of the network. The effectiveness of the illustrated control is unique, as the power sharing occurs via dc grid, thus it has been tested on PSCAD with test cases.

SS3004 Presentation 10 (14:35~14:50)

Optimal Sizing of a Networked Microgrid Using Nash Equilibrium for Mount Magnet

Liaqat Ali[1], H. Bizhani[2] , S. M. Muyeen[3] , and A. Ghosh[4]

1, Curtin University, Perth, Australia
2, University of Zanjan, Zanjan, Iran
3, Curtin University, Perth, Australia
4, Curtin University, Perth, Australia

Abstract — In this paper, a technique of game theory is proposed based on a multi-objective imperialistic competition algorithm ICA for system optimization in order to design a networked microgrid in grid-connected mode. The selected networked microgird, which consists of two different grid-connected microgrids with common load and grid, might have different combinations of generation resources including wind turbine, photovoltaic panels and batteries. To perform the effective sizing of networked microgrid, a Nash equilibrium based game theory is developed in which the rating of the generation systems is considered as players and annual profit as payoff. Moreover, in order to meet the equilibrium point and find the optimum sizes of generation resources in different coalitions between players, ICA, which is being frequently used in optimization applications, is implemented using MATLAB software. Finally, in order to validate the results, the sensitivity analysis is studied to examine the impact of electricity price and discount rates.

Paper Details

Session 2
Topic: "Distributed Generations and Microgrid"
Session Chair: Dr. Enamul Haque

SS0043 Presentation 11 (14:50~15:05)

Theoretical Analysis of a Solar PV-Wind Hybrid Power System for Energy Generation in Kutch Region

Alpesh Desai[1], Abhijit Ray[2], Indrajit Mukhopadhyay[3]
1,2, Department of Solar Energy, Pandit Deendayal Petroleum University (PDPU) Gandhinagar, India
3, Solar Research Development Centre (SRDC), Pandit Deendayal Petroleum University (PDPU) Gandhinagar, India

Abstract — Solar PV-Wind Hybrid Power System that uses renewable sources to supply power to grid to meet the power requirement. Theoretical Mathematical Modeling and its Generation analysis showed that solar radiation and wind are the most important physical variables for the Solar PV-Wind power system design. The study proposes Solar PV-Wind based system, affordable by local government standards to respond to the electricity demand of that state, is the one with an irradiance between 2.6 to 7 kWh/Day/m2 and wind speed between 6.6 to 15.5 miles per hour. The annual average daily yield, annual average monthly yield and total average Capacity Utilization Factor (CUF) are 5 kWh/kWp/Day, 157 kWh/kWp/Month and 21 % Respectively for solar pv-wind hybrid power system total Generation for Kutch region. The model shows that with the help of Solar PV-Wind Hybrid Power System we can forecast the energy generation of minimum 30 % and maximum 70 % energy generation which can be utilize in state with the modification of existing infrastructure hence infrastructure cost can be saved and waste land between the wind mills can also be utilized.

SS0056 Presentation 12 (15:05~15:20)

Feasibility of Algae Photobioreactor as Fa çade in the Office Building in Indonesia

N A Ardiani[1,3], M D Koerniawan[1,3], W Martokusumo[1], E A Suyono[2,3], H W Poerbo[1]
1, Department of Architecture, Institut Teknologi Bandung, Bandung, Indonesia, 40132
2, Faculty of Biology, Universitas Gadjah Mada, Yogyakarta, Indonesia, 55281
3, Centre for Development of Sustainable Region (CDSR), Yogyakarta, Indonesia, 55281

Abstract — Algae has a high potential as a renewable energy resource. Recent studies about algae photobioreactor application in the building fa çade seem promising and the first algae building has been constructed in Hamburg, Germany. However, the application of algae photobioreactor in the hot and humid climate is still limited. This paper will discuss about feasibility of algae photobioreactor as fa çade in the office building by evaluating the model from Sketchup software. This is a real project of a new office building in Institut Teknologi Bandung campus. The algae photobioreactor is planned to be installed in the west fa çade as shading devices and renewable energy resources. It is assumed that the acrylic moulding would work better to reduce leakage issues and the possibility of killing the algae.

Paper Details

Session 3

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 13:50~15:20
Venue: **Ke1.104 Room**

Topic: "Power System Dynamics and Protection"

Session Chair: Dr. Apel Mahmud

SS0044 Presentation 13 (13:50~14:05)

Coordination of Directional Overcurrent Relays for Distribution System using Particle Swarm Optimization

Deepak Vyas, Dr. Praghnesh Bhatt, Vipin Shuklaa
Pandit Deendayal Petroleum University, Raisan, Gandhinagar, Gujarat, 382007 India

Abstract — The protection of electrical distribution network with multiple loops and bidirectional power flow needs optimal coordination of directional overcurrent relays (DOCRs). The DOCRs coordination is highly non-linear and largely constrained optimization problem where plug settings (PS) and time dial settings (TDS) of DOCRs are set as control variables. The objective function in this paper is based on minimizing the operating time of all primary DOCRs considering far-end and near-end fault approach. The optimization is performed with particle swarm optimization (PSO) for standard test systems of 3-bus, 4-bus and 6-bus and the results are compared with the existing methods of relay coordination reported in literature. The optimized PS and TDS for DOCRs has resulted in the least value of objective function along with proper coordination time interval for all test systems.

SS0010 Presentation 14 (14:05~14:20)

Performance Improvement of Asymmetrical-pole Partitioned Stator Permanent Magnet Generator by Optimizing Stator Teeth Number

W Sriwannarat[1], A janon[2], A Siritaratiwat[1], and P Khunkitti[1]
1, Department of Electrical Engineering, Faculty of Engineering, Khon Kaen university, Khon Kaen, Thailand 40002
2, Department of Machanical Engineering, Faculty of Engineering, Khon Kaen university, Khon Kaen, Thailand 40002

Abstract — The partitioned stator doubly salient permanent magnet generator (PS-DSPG) with asymmetrical-pole configuration has been widely applied for producing electrical power due to their high reliability, high flux linkage and high electromagnetic force (EMF). Therefore, we aim to improve the performance of this generator an asymmetrical-pole structure technique applied to outer stator pole. The phase flux linkage and phase EMF were characterized by finite element method. It was verified that the flux linkage and EMF were increased when increasing the number of outer stator. Especially, the 30/8/14-pole (outer stator/rotor/PM-pole) of PSDSPG structure with asymmetrical-pole technique produced high symmetric EMF waveform. the arc variation of rotor iron piece of all proposed structures was investigated. It was found that the 30/8/14-pole of the proposed asymmetrical-pole PS-DSPG structure provides EMF about 61.29% higher than the conventional structure at expanded rotor arc of 140%. Hence, the 30/8/14-pole asymmetrical-pole PS-DSPG structure can be utilized for electrical generation in low-speed applications.

Paper Details

Session 3

Topic: "Power System Dynamics and Protection"

Session Chair: Dr. Apel Mahmud

SS3007 Presentation 16 (14:20~14:35)

Identifying Flexible Pool Pumps Suitable for Distributed Demand Response Schemes

Lachlan L. H. Andrew[1], Draga Doncila Pop[2], **Reza Razzaghi[3]**, David L. Dowe[2]
1, School of Computing and Information Science, University of Melbourne
2, Faculty of Information Technology, Monash University
3, Department of Electrical and Computer Systems Engineering, Monash University

Abstract — Demand response will be an important tool as non-dispatchable generation is added to the grid. Swimming pool filtration pumps are a promising appliance for the grid operator to control because, unlike air conditioners, their time of operation can be shifted by a day without affecting their primary role. Although many customers set and forget the timer settings, this paper studies smart meter data and demonstrates that many change the settings frequently. A "care index" is proposed that quantifies how much a customer appears to care about the precise timing of pump operation, which indicates how willing they are likely to be to relinquish control to the grid operator.

SS3008 Presentation 17 (14:35~14:50)

The Optimal Stator Design of Novel Three-phase Doubly Salient Permanent Magnet Generator for Improving the Generator Output

V. Lounthavong[a], W. Sriwannarat[a], C. Surawanitkun[b] , R. Chatthaworn[a], A. Siritaratiwat[a] and P. Khunkitti[a*]
a, Department of Electrical Engineering, Faculty of Engineering, Khon Kaen University, Khon Kaen 40002, Thailand
b, Faculty of Applied Science and Engineering, Khon Kaen University, Nong Khai Campus, Nong Khai 43000, Thailand

Abstract — As widely indicated in many recent studies that the Doubly Salient Permanent Magnet (DSPM) generator could provide high electromotive force (EMF), this paper proposes an optimal structure design of DSPM generator for improving the generator output. The finite element method was performed in the simulations and analysis. The effects of stator structural parameters, including the thickness of permanent magnet (PM) and the inner stator depth on the output characteristics of generator were demonstrated. The generator outputs including the magnetic flux-linkage, magnetic flux distribution, EMF and voltage regulation were discussed. The results showed that the magnetic flux-linkage and the EMF of proposed optimal structure could be significantly improved by an adjustment of the PM thickness and stator depth. An optimal thickness of PM and inner stator depth regarding this particular generator was chosen. The magnetic flux distribution analysis was also carried out to confirm the simulation results. It was found that the optimal structure of DSPM can be achieved by increasing the PM thickness to be 150 % with reducing the stator pole depth to be 80 % of the those conventional values. The flux-linkage and EMF produced by the proposed optimal structure are 15.88 % and 6 % higher than that of conventional structure. Moreover, the optimal structure also provides greater voltage regulation profile than conventional structure. Then, the optimal design of PM thickness and inner stator depth regarding this particular generator model can be adapted any other PM machine design in order to maximize the generator output.

Paper Details

Session 3
Topic: "Power System Dynamics and Protection"
Session Chair: Dr. Apel Mahmud

SS0024 Presentation 15 (14:50~15:05)

TravellingWave Fault Location System based on IEC61850

Yanzhou Chen, Haohui Su, Yanlei Cai, Qi Wang
Maintenance & Test Center, EHV Company, China Southern Power Grid, Guangzhou, China

Abstract — Travelling wave fault location (TWFL) system has been matured in recent years due primarily to the availability of high speed sampling techniques, fast communications technology and GPS time synchronization. However, it has not yet been fully integrated into the digital substation based on IEC61850 standard. Proposal for modeling the TWFL system by the IEC61850 standard has already been proposed in another paper. This paper focuses on the communication requirements of the TWFL system in a digital substation, both at the station level and the process level. The application of GOOSE messages and the need for high speed sampling merging unit are discussed. The paper also reports on the latest research into the electronic transformer technology which can satisfy the high speed sampling requirements of TWFL.

Paper Details

Session 4

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 15:40~17:10
Venue: **Ke1.207 Room**

Topic: "Smart Building, Smart Cities and Smart Grid"

Session Chair: Dr. Mohammad Arif

SS0016 Presentation 18 (15:40~15:55)

Identifying Malware on Cyber Physical Systems by Incorporating Semi-Supervised Approach and Deep Learning

Shaila Sharmeen, Shamsul Huda and Jemal Abawajy
School of IT, Deakin University, Melbourne, Australia

Abstract — Malicious applications can be a security threat to Cyber-physical systems as the Cyber-physical systems are composed of heterogeneous distributed systems and mostly depends on the internet, ICT services and products. The usage of ICT products and the services gives the opportunity of less expensive data collection, intelligent control and decision systems using automated data mining tools. Cyber-physical systems become exposed to the internet and the public networks as it has integrated to the ICT networks for easy automated options. Cyberattacks can lead functional failure, blackouts, energy theft, data theft etc. and this will be critical security concern of Cyber-physical systems. At present, the mobile devices are replacing the pc environment and become a key element of Internet of Things. Therefore, it is essential to develop such a malware detection engine that will identify the mobile malware and reduce the spreading of the malicious code through mobile devices. This research work will identify the malware by incorporating semi-supervised approach and deep learning. The original and significant contributions are to propose an effective malware detection model by incorporating semisupervised approach and deep learning, to implement the model using parallel processing and to evaluate the performance of the model using recent dataset. Here we have used the permission and the API call as the features. The proposed method has been tested on the real mobile malware data set and it shows improvement in accuracy. The Experimental results show that the deep learning along with semi-supervised method will be an effective way to identify the malware and it outperforms other detection methods.

Paper Details

Session 4

Topic: "Smart Building, Smart Cities and Smart Grid"

Session Chair: Dr. Mohammad Arif

SS0035-A Presentation 19 (15:55~16:10)

Low-Voltate Distribution Network Impedance Estimation Based on Smart Meter Data

Sergey Iakovlev[1], Iven Mareels[2], Robin Evans[1]
1, The University of Melbourne, Australia
2, IBM, Australia

Abstract — Under conditions of high penetration of renewables, the low-voltage (LV) distribution network needs to be carefully managed. In such a scenario, an accurate real-time low-voltage power network model is an important prerequisite, which opens up the possibility for application of many advanced network control and optimisation methods thus providing improved power flow balancing, reduced maintenance costs, and enhanced reliability and security of a grid.

Smart meters serve as a primary source of information in LV networks and allow for accurate measurements at almost every node, which makes it advantageous to use data driven methods. We formulate an optimisation problem based on a non-linear power grid model, solve it efficiently, and propose a number of fully smart meter data driven methods for line parameters estimation, including phase information. Our algorithms are fast, scale linearly with the number of nodes, do not require PMU availability, and can be executed in a decentralised manner. The performance of these algorithms is demonstrated for different measurement accuracy scenarios through simulations.

SS0011 Presentation 20 (16:10~16:25)

Roles and Challenges of Network Sensors in Smart Cities

N Alharbi[1], B Soh[2]
1&2, Department of Computer Science and Computer Engineering, La Trobe University, Australia

Abstract — The study in this paper is in response to an increasingly technological and connected world. Scientific discoveries, engineering achievements, and social dynamics have led to the evolution of human societies. In the last two decades, ways in which people interact and live have changed, mainly because of the new technologies. In this paper, we explore the roles and challenges of network sensors as elements of a smart city and propose solutions and implications to address the challenges.

Paper Details

Session 4
Topic: "Smart Building, Smart Cities and Smart Grid"
Session Chair: Dr. Mohammad Arif

SS0017 Presentation 21 (16:25~16:40)

Privacy and Security Challenges and Solutions in IOT: A review

N Alhalafi [1*], Prakash Veeraraghavan[2]
Department of Computer Science and Computer Engineering, La Trobe University, Australia

Abstract —The Internet of Things (IoT) is a revolutionary concept that heavily relies on the network infrastructure to connect large number of devices whose main purpose is to collect data and communicate among one another in the bid to enhance their decision- making capabilities. However, with this great evolution comes various challenges that threatens the information technology industry; these include security and privacy issues. The presence of a large number of interconnected technologies open a grey area in the IT field which has been worsened by the lack of capacity of various institutions to identify, assess and monitor important components to ensure compliance with security policies. Thus, there is need for a clear understanding of the issues at hand and how they can be solved in order to fully harness this capability.

SS0028 Presentation 22 (16:40~16:55)

A Customer-based-strategy to Minimize the Cost of Energy Consumption by Optimal Utilization of Energy Resources in an Apartment Building

S Rafique, MSH Nizami, UB Irshad, MJ Hossain and GE Town
School of Engineering, Macquarie University, Sydney, Australia

Abstract — Global energy consumption in heating and cooling of buildings and in the transport sector together accounts for approximately two-thirds of total energy consumption. Consequently, it is important to maximize the use of renewable generation energy in these sectors, and to optimize the use of that energy by managing diverse sources and loads. This is particularly challenging in high-density residential premises where the space for such infrastructure is limited, and storage can have significant impact on energy utilization and demand. In this paper, we describe a customer-based strategy (CBS) to optimize the usage of the available energy resources in such scenarios. The effectiveness of the strategy was validated for an apartment block of 20 households with photovoltaic generation (PV) and stationary battery storage (BS) systems, each with a vehicle-to-grid (V2G) capable electric vehicle (EV). The modelling used real data for customer demand and included the cost of battery degradation and expected vehicle usage in optimizing resource scheduling. Substantial savings in energy costs were shown to be possible for each customer.

Paper Details

Session 4

Topic: "Smart Building, Smart Cities and Smart Grid"

Session Chair: Dr. Mohammad Arif

SS0051 Presentation 23 (16:55~17:10)

The Predictor for Urban Buildings' Hourly Electricity Consumption

Shubing Shan[1] ,Buyang Cao[2] and Zhiqiang Wu[1],
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Abstract — The accurate prediction approach of urban buildings' electricity consumption is an important foundation for smart urban energy management. It provides the decision basis for electricity deployment at peak times. This paper presents a knowledge graph of urban building electricity consumption called ECKG. It provides an effective way to obtain the influencing factors of buildings' electricity consumption. In addition, in order to improve the accuracy of prediction, this paper proposes the logarithmic electricity consumption gravity model and error correction model based on data selection. We use 17520 hours' electricity consumption of a five-star hotel building in Shanghai, China as the study case, and 8 common models as benchmarks to conduct the comparisons. Our approach outperforms all benchmarks in terms of average accuracy.

Paper Details

Session 5

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 15:40~17:10
Venue: **Ke2.202 Room**

Topic: "Power Electronics and Energy Conversion"

Session Chair: Dr. Sajeeb Saha

SS0019 Presentation 24 (15:40~15:55)

A Novel Capacitor Voltage Balancing Method for MMCs with Less Computation and Lower Switching Frequency

Xin Gou, Jiping Lu and Wenling Deng
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Abstract — Aiming at the computation complexity and high switching frequency existing in conventional voltage balancing method of high-level modular multilevel converters (MMCs), a novel capacitor voltage balancing method based on insertion priorities of sub-modules (SMs) is proposed. Instead of sorting the voltage values of SMs, an Allowable Capacitor Voltage Distribution Band (ACVDB) is applied to constrain the fluctuation range of capacitor voltages. And the insertion priorities of SMs in current control cycle are determined by comparing their voltage values in last control cycle with the upper and lower limits of ACVDB respectively. The effectiveness of the proposed method is validated by a 41-level MMC model in MATLAB/ Simulink R2017a. Simulation results demonstrate that the switching frequency can be reduced significantly with an allowable deviation of capacitor voltages in both steady state and transient process.

SS0031 Presentation 25 (15:55~16:10)

Predictive Torque Control of Three-level Sparse Neutral Point Clamped Inverter fed IPMSM Drives using Simplified Deadbeat Principle

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Abstract — This paper proposes a predictive torque control for interior permanent magnet synchronous machine (IPMSM) driven by three-level sparse neutral point clamped inverter. It contributes to greatly diminish the torque and flux ripples by using predictions and three voltage levels. To precisely synthesize the voltage vectors, deadbeat principle is employed. Different from existing works, the proposed control method is implemented in stationary reference frame, eliminating coordinate transformations. Furthermore, one cycle delay is compensated through predictions. In addition, to further reduce the torque and flux ripples, three-level sparse neutral point clamped inverter (3L-SNPCI) is employed. In comparison with other types of three-level inverters, it utilizes fewer power semiconductors and has alleviated neutral point voltage fluctuation problem. Space vector modulation is employed to generate the switching signals for the 3L-SNPCI. The validity of the proposed approach is verified by experimental results.

Paper Details

Session 5
Topic: "Power Electronics and Energy Conversion"
Session Chair: Dr. Sajeeb Saha

SS0033 Presentation 26 (16:10~16:25)

Impact of Transformer's Leakage Inductance on Duty Cycle in Isolated Dc-dc Converters

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Abstract — Switching power supplies utilizing isolated dc-dc converter are seeing increased use to power today's consumer electronics and home appliances. However, for all the benefits of dc-dc converters such as efficiency, problems still exist with their use. One issue relates to leakage inductance of transformer used in the isolated dc-dc converters, which is often seen as one of the major contributors to degradation in performance. Leakage inductance's role in circuit losses, changes in load regulation, and noise created by the given converter has been widely known. However, its direct impact on the operating duty cycle of the converter has not been investigated. This paper aims to examine the impact of leakage inductance to duty cycle in two popular isolated topologies, namely the single-switch forward and the flyback converters. The study used computer simulation to observe the effect of worsening the leakage inductance through transformer's coupling coefficient. Results from computer simulation reveal a nearly linear relationship between leakage inductance and duty cycle. Under the given simulation parameters, the change in duty cycle reaches as much as 12.8% for the single-switch forward converter and 6.8% for the flyback converter.

SS0052 Presentation 27 (16:25~16:40)

A Study on Modeling of Effective Series Resistance for Lithium-ion Batteries under Life Cycle Consideration

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Abstract — This paper presents a modeling of effective series resistance for Lithium-ion batteries, which is focusing on the effect of life cycles in aging cells during operations. A computer-based sequential control system is developed to prepare aging cells and automatically characterize the information of testing batteries. Several aspects of testing parameters during the charge and discharge, such as characteristics of the effective series resistance, amplitudes of the pulse current, changes of the increasing resistance, state of charge, capacity and operating cycles, are considered and analyzed to implement in the effective series resistance model. A methodology based on the experiment of pulse tests is applied as sequential steps for modeling the effective series resistance with life cycle consideration. Comparison results between the proposed model and measured values over the life cycle of the battery show the satisfactory verification with the maximum error lower than 4%.

Paper Details

Session 5

Topic: "Power Electronics and Energy Conversion"

Session Chair: Dr. Sajeeb Saha

SS0014 Presentation 28 (16:40~16:55)

Small-signal Analysis of a Dual-input DC-DC Buck Converter

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Abstract — This paper presents a small signal modelling and voltage-mode control of a pulse-width modulated (PWM) dual-input DC-DC buck converter. The control of multiple switches in a power converter is the main challenge for multiple-input converters addressed in this paper. Using the concept of linearization and perturbation depicted in circuit averaging technique, the closed-loop small signal model for multi-input DC-DC buck converter is derived. The closed loop control to output voltage transfer function is derived. A brief compensator design is introduced for a multi-input buck converter. In order to control the duty cycles of multiple switches and control the output voltage, a new variable is introduced to relate the duty cycles in the closed loop control to output voltage transfer function. The analysis and controller design are simulated in LTSpice.

SS3006 Presentation 29 (16:55~17:10)

Thermal Energy Storage Using Strontium Bromide Hexahydrate

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Abstract — There are various methods to store thermal energy from season to season. Because the density of energy storage in thermochemical materials is higher than the latent and sensible heat storage method, the thermochemical heat storage is considered the sufficient type. This paper provides a mathematical model of thermochemical storage process for thermochemical materials; strontium bromide hydrate (SrBr2.6H2O). The software used is COMSOL Multiphysics Modelling Software. The model data is validated and compared with the previous experimental result. Furthermore, the temperature difference and the pressure over the material inside the reactor are investigated. There are seven designs for the bed. However, the inlet and outlet diameter of the bed is changed; there is any change in the volume and height of the bed. The model results present that the rise in entrance area decreases the charging time and raises the pressure drop inside the material. Case 4 is the best design from the charge time.

Paper Details

Session 6

Tips: The schedule for each presentation is for reference only.
In order not to miss your presentation, we strongly suggest that you attend the whole session.
Afternoon, April 26, 2019 (Friday)
Time: 15:40~17:10
Venue: **Ke1.104 Room**

Topic: "Control, Automation, and Energy Harvesting"

Session Chair: Prof. Tyrone Fernando

SS0041 Presentation 30 (15:40~15:55)

The Array Microstrip Antenna for Mobile-internet of Satellite Energy Communications

Muhammad Fauzan Edy Purnomo[1*], Vita Kusumasari[2*], Rini Nur Hasanah[3], Hadi Suyono[4], Akio Kitagawa[5]
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Abstract — A simple Left-Handed Circularly Polarized (LHCP) proximity-fed equilateral-triangular array antenna with hole is proposed in order to support the mobile-internet of satellite energy communication covering the area of Japan (beam coverage elevation, El = 38° to 58°). In this paper, single-band LHCP triangular-patch array antenna is developed for receiver on ground applications. The targeted minimum gain of the antenna is set to 5 dBic at the central elevation angle (El = 48°), in Tokyo area, for applications using data-internet transfer of around hundreds kbps. The antenna consists of three equilateral-triangular patches with a hole for reception units operating at 2.50 GHz frequency bands. The antenna is simulated using the Method of Moments (MoM) analysis. The simulation results show that the frequency characteristics and the 3-dB axial ratio coverage in the conical-cut direction of the simulated antenna satisfy the target.

Paper Details

Session 6

Topic: "Control, Automation, and Energy Harvesting"

Session Chair: Prof. Tyrone Fernando

SS0045 Presentation 31 (15:55~16:10)

Robot Movement System Design based on the Recorded Movement of a Cloning Robot

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Abstract —Automation has been applied in many sectors of human life including systems involving robots. This paper has been based on the need to improve the movement system in a dancing robot. The beauty of a robot dance is measured by flexibility, liveliness, and synchronization of the robot dance with its accompanying music rhythm. Robot flexibility, in order not to move stiffly, is influenced by the movement angle of the joints. The design of a movement system has been based on the recorded movement of a master robot, being called as the cloning robot. It is purposed to get a fast and easy-to-read response to help a programmer to obtain the dance movement algorithms faster by using easy-to-obtain (cheap and commonplace) sensors and motors. The experiment results indicate that the movement system of the competition robot has been successcully built based on the recorded movement of the cloning robot. The good performance of the sensor has been shown with only 0.02V of average error during the test on 10 sensors used, with the lowest error of 0V and the largest error of 0.07V. The most effective angle measurement of the sensor has been achieved in the range of 30° - 280° out of the available 0° - 305° range of angles. The analog-to-digital conversion process indicates the conversion linearity, with an error of 0.18 bits (0 bits) within the range of 0 – 1023 bits. The results of testing on the angles of the servo system indicate the biggest error of 5° and the smallest error of 1° . The overall test results show the biggest error difference of 23.33° and the smallest one of 0.30° .

SS0003 Presentation 32 (16:10~16:25)

Problems of Low Emission in Poland in Sectoral Terms

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Abstract — The problem of low emission in Poland has been unresolved for many years. One should be aware that when planning activities to reduce low emission, it is necessary to determine in which sectors of the national economy the problem is the most serious. In this way, it will be possible to intensify activities in areas that contribute the most to the emission of pollutants entering the air. For the purposes of analyses undertaken in this publication, low emission should be defined as pollution, which enters the air at a height not exceeding 40 meters from the ground level. The aim of the article was to identify problems related to the creation of low emission in Poland in sectoral terms.

Paper Details

Session 6

Topic: "Control, Automation, and Energy Harvesting"

Session Chair: Prof. Tyrone Fernando

SS0021 Presentation 33 (16:25~16:40)

A Numerical Approach for Buildings Reduced Thermal Model Parameters Evaluation

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4, Shanghai Maritime University, Shanghai, China

Abstract — This paper introduces an efficient PSO-based optimization method to identify parametric values of buildings reduced thermal RC network models. A high order reference model representing energy flow through building envelope is developed based on Crank-Nicolson finite difference method. Thermal network models performance with random resistance and capacitance values are compared with a reference model then PSO is used for parameters identification to match the actual reference model thermal dynamics. The accuracy and computational cost of these optimized models are validated against reference model for different construction classes. The proposed methodology presents an effective way to develop a reliable thermal network model representing realistic thermal dynamics in building that can be used to improve efficiency of controlling techniques.

SS0040 Presentation 34 (16:40~16:55)

Energy Harvesting System with Multiple Inputs

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3, Electrical Engineering Department, University of Jember, Indonesia

Abstract — Energy scavenging system that can harvest from multiple energy sources has been considered and remains a promising research topic. This paper presents characterization of a multiple input energy harvesting system for Wireless Sensor Network and evaluation of battery state of charge utilized in the system. The system under study automatically selects the highest voltage value from among connected harvested energy sources to determine which of the multiple sources will supply energy to charge the system's battery and any operating load. By means of the coulomb counting method in the wireless application board and under the regulated maximum input voltage of the application board of 3.3 V, the state of charge (SOC) of the system battery was observed to study the functionality and effectiveness of the multiple input energy harvesting system. Further hardware test results show approximately 0.013% of SOC is obtained.

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Location Maps

BUILDING KE - LEVEL 01
GEELONG WAURN PONDS CAMPUS
Last Update : 11 October 2017

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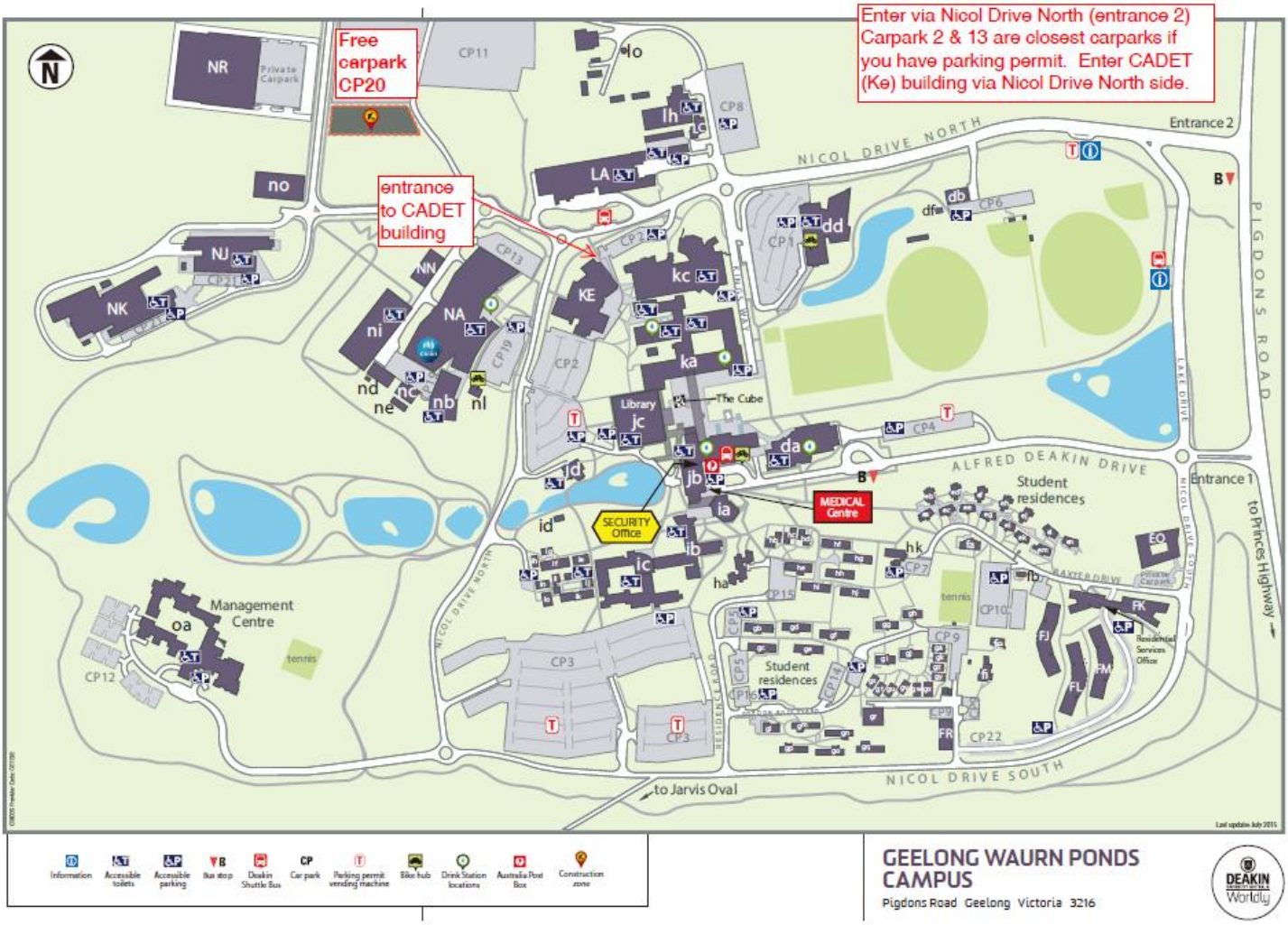
Discipline: Architectural

Scale: *(Please refer to scale bar in drawing)*

Location Maps



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