Symposium on Plasma And Nuclear Systems

SPANS-2014

Friday, August 15, 2014, 9 am to 4 pm

Room: UA1240

UOIT – Oshawa, ON, Canada

Sponsors: IEEE-Toronto, NPSS Chapter, CNS – UOIT Chapter, CNS – Fusion Science and Technology Division, CAP – Plasma Physics Division, IEEE-Canada

Chair: Professor Hossam A.Gabbar (UOIT),

Contacts: Hossam.Gabbar@uoit.ca

Information and updates, visit: www.sege-conference.com/SPANS.PDF

Canadian Nuclear Society, IEEE-SEGE-2013

TOPICS

- **Plasma Devices and Applications.**
- **Plasma Experiments, Diagnostics and Control.**
- **Plasma Simulation and Modeling.**
- **Nuclear Power Plant Safety Systems.**
- **Nuclear Power Plant Control Systems.**
- **Nuclear Power Plant Monitoring and Measurement Systems.**

Objectives of Symposium

- **This symposium is providing forum for researchers from academia and industry to present and discuss latest research innovations in nuclear and plasma systems.**

- **SPANS will provide attendees with state-of-the-art research and technologies and engage in active discussions with industry. Also it will provide industry with opportunities to promote their products and business cases.**

- **Attendees from regulators and standards will engage in fruitful discussions on how R&D is linked with regulations and standards.**

Agenda

8:15	8:45	Registration
8:45	9:15	Hossam A.Gabbar, UOIT
9:15	10:00	Mahmoud Kattan, CANDU Energy Inc.
10:00	10:20	Emmanuel Boafo, UOIT
10:20	10:50	Break
10:50	11:30	Sayf Elgriw, UOIT
11:30	11:50	Daniel Bondarenko, UOIT
11:50	12:15	Elnara Nasimi, UOIT
12:15	13:15	Lunch
13:15	14:00	T. (Nithy) Nitheanandan, AECL
14:00	14:45	Patrick Carle, General Fusion
14:45	15:00	Andrew Wallace, HOPE Innovations Inc.
15:00	15:30	Break
15:30	16:00	Ralph Chatoor, OPG
16:00	16:30	Harsh Deol, OPG
16:30	16:45	Closing

SPANS-2014

Registration Fees: $50

(Discount fee of $30 for students, IEEE, CNS, and CAP Members)

Space is Limited (60 to 100 max)

Registration Deadline

4-Aug, 2014

For Registration: www.sege-conference.com/SPANS.html

Opening of SPANS-2014

Hossam A. Gabbar, UOIT

Advances in control, safety, and diagnostics in plasma and nuclear systems

Reactor Safety R&D at Chalk River Laboratories – Understanding Phenomena and Instrumentation

T. Nitheanandan, AECL

Evolution of CANDU(r) Plant Digital Instrumentation and Control

Mahmoud Kattan, CANDU Energy Inc.

Managing Regulatory Compliance – A Pickering Nuclear Perspective

Ralph Chatoor, OPG

Overview on Instrument Air at a Nuclear Power Plant

Harsh Deol, OPG

Introduction to plasma diagnostics at General Fusion

Patrick Carle, General Fusion

Abstract

An overview will be given of plasma diagnostics at General Fusion. These diagnostics include magnetic probes, interferometry, polarimetry, impurity spectroscopy, Thomson scattering, neutron detectors, x-ray photodiodes and a high-speed xray-phosphor camera. Research into new diagnostics to measure the twistedness of magnetic field lines inside the plasma (q-profile) will also be presented.

Diagnostic Tools and Numerical Simulations for the Planned Plasma Experiment at UOIT

Sayf Elgriw, Hossam A. Gabbar, UOIT

Abstract

In the preparation of plasma experiment at UOIT, several diagnostics and numerical simulations are being developed. Any plasma experiment requires a set of diagnostics tools and signal processing techniques to monitor various parameters and to analyse the associated signals in plasma discharge circuits and in the plasma itself. Other analytical models are currently being developed to simulate MHD equilibrium, plasma profiles and current discharge in the plasma experiment that will take place at UOIT.

Real Time Simulation Tuning for Fault Propagation Analysis in Nuclear Power Plants

Emmanuel Boafo, Hossam A. Gabbar, UOIT

Abstract

In this study, we present a framework for achieving safety verification of a nuclear power plant with emphasis on using co-simulation with reduced error for real time fault propagation analysis based on Fault Semantic Network, in which a multiphysics model is mapped unto fault models. A statistical method is used to reduce errors between simulation results and real time data which is illustrated with a case study from literature.

Importance of data pre-processing for FSN-based troubleshooting at CANDU® Stations

Elnara Nasimi, Hossam A. Gabbar, UOIT

Abstract

Over the past several years a number of domestic CANDU® stations have experienced issues with neutron detection systems that challenged safety and operation. Intelligent troubleshooting methodology is required to aid in making risk-informed decisions related to design and operational activities, which can aid current stations and be used for the future generation of CANDU® designs. A new fault modeling approach using Fault Semantic Network (FSN) with risk estimation is proposed for this purpose. The proposed system involves three major processes that include detecting faults, extracting patterns and features and making decisions. It is typical to have missing, incomplete or corrupted data points in large process data sets from dynamically changing systems. Therefore, it is expected that quality of obtained data will have a direct impact on the system's ability to recognize developing trends in the process upset situations.

In order to enable fault detection process, intelligent filtering techniques are required to de-noise process data and extract valuable signal features in the presence of background noise. In this study, it is proposed to apply an optimized and intelligent filtering of process signals prior to data analysis. This is particularly important for neutronic signals in order to increase signal to noise ratio (SNR) which suffers the most during start-ups and low power operation. This work is complimentary to the previously published studies on FSN-based fault modeling in CANDU stations.

Functional modelling and risk assessment of plasma experiment

Daniel Bondarenko, Sayf Elgriw Hossam A. Gabbar, UOIT

Abstract

High voltages, currents, temperatures, and pressures encountered among a range of plasma technologies can lead to unnecessary risks for the people and the environment. However, there is no particular method for systematic and easy safety verification of any particular plasma device. The challenge of structuring a universal methodology for any particular plasma device is due to the fact that there are different plasma devices with different specifications and configurations. In the work presented herein, an approach to risk assessment of plasma devices is demonstrated in terms of the equivalent structure methodology. It is purposed that the methodology presented herein will be useful for future plasma engineers, thereby mitigating any dangers in the future plasma devices.

Dr. Hossam A. Gabbar

Is an Associate Professor in the Faculty of Energy Systems and Nuclear Science, and cross appointed in the Faculty of Engineering and Applied Science, University of Ontario Institute of Technology (UOIT). He obtained his Ph.D. degree (Energy Process Safety) from Okayama University (Japan), while his undergrad degree (B.Sc., with First Class of Honor) and Master degree courses are in the area of automatic control from Alexandria University, Egypt. He is specialized in smart energy grids with focus on safety, protection, and control engineering. Since 2004, he was an Associate Professor in the Division of Industrial Innovation Sciences at Okayama University, Japan. And from 2001, he joined Tokyo Institute of Technology and Japan Chemical Innovative Institute (JCII), where he participated in national projects related to advanced distributed control and safety systems for green energy and production systems. He is founding general chair of the annual international conference on smart energy grid engineering, which is held at UOIT. HE is the founding Editor-in-chief of International Journal of Process Systems Engineering (IJPSE). He is regularly invited to give talks in scientific events and conferences, tutorials, and industrial development programs in the area of energy safety and control. Dr. Gabbar is the author of more than 110 publications, including books, book chapters, patent, and papers in the area of smart energy grids, safety and control engineering.

Dr. T. (Nithy) Nitheanandan

Manager

Fuel & Fuel Channel Safety Branch

AECL, Chalk River Laboratories

Dr. Mahmoud Kattan

Is the Director - Electrical, C&I and Computer Engineering, Candu Energy Inc. and a member of CSA N290 Committee. His responsibilities include,

- **To ensure qualified technical resources and processes are available to execute projects, and oversee preparation of technical input to proposals.**
- **Primary work is focused on New Build, Refurbishment and Technical Engineering Services for the CANDU Nuclear Steam Plant scope.**

Dr. Kattan earned his Bachelor, Master and PhD degrees in Chemical Engineering

Dr. Ralph Chatoor

Dr. Chatoor is currently a section manager in the department of Regulatory Affairs at Pickering Nuclear, Ontario Power Generation. By training he is a Professional Engineer, a Barrister-At-Law and holds a Ph.D. in the field of leadership studies. Through his career, Dr. Chatoor has worked in various industries including: medical care, mining, pulp and paper, forensic consulting, law and nuclear energy.   He has published in the area of political leadership formation.

Dr. Chatoor can be reached by email: ralph.chatoor@opg.com or by phone: 905-839-1151 x 6679.

Harsh Deol

Harsh graduated with Bachelors of Nuclear Engineering Degree from UOIT in April 2008. He is presently pursuing Masters of Nuclear Engineering (MASc) at UOIT on part-time basis to further develop into a Nuclear expert.

Harsh started working for Ontario Power Generation (OPG) in Sep, 2008 and thus far has worked at Performance Engineering, Equipment Reliability, Design Projects etc to support various systems that include compressed air systems, Emergency Communication System and HVAC systems etc. Deliverables include system performance monitoring, surveillance, troubleshooting and status reporting to improve equipment reliability and achieve industry standards.

Working as System Engineer, Harsh received Chief Nuclear Officer (CNO) recognition and five Values in Action (VIA) awards for his work performance that are testimonial to his hard work, good organization and leadership skills. In addition, he is presently pursuing (Acting) Section Manager role at OPG to further develop his leadership skills at OPG.

Dr. Patrick Carle

Patrick Carle recently obtained his PhD from Queen's University in Kingston, Ontario. His research was in partnership with General Fusion and focused on designing and building a polarimeter diagnostic for an accelerated spheromak plasma. Patrick has returned to General Fusion and his current project is to determine the twistedness of magnetic fields lines (q-profile) in plasmas.

Dr. Sayf Elgriw

Dr. Elgriw is a post-doctoral fellow at UOIT. He obtained his M.Sc. and Ph.D. degrees in Engineering Physics (Experimental Plasma Physics) from the University of Saskatchewan (Canada). He also obtained a B.Sc. Degree in Nuclear Engineering from the University of Tripoli (Libya). Dr. Elgriw has been awarded the Best Student Paper Award in CAP Congress 2008 for the Division of Plasma Physics, B. W. Currie Memorial Graduate Scholarship, William Rowles Fellowship in Physics and Engineering Physics, Canadian Bureau for International Education (CBIE) Doctoral Scholarship, and Saskatchewan Innovation and Opportunity Scholarship. He worked on several experimental plasma techniques including ultrahigh vacuum technology, plasma diagnostics, electronics, feedback control systems, data acquisition and signal processing techniques. Dr. Elgriw has published over 15 articles in various international journals and conference proceedings. He also served as a reviewer for the IAEA Nuclear Fusion Journal.

Elnara Nasimi

- Currently a Ph.D. student in the University of Ontario Institute of Technology (UOIT).
- Masters in Applied Science in Nuclear Engineering (2010) from UOIT, Oshawa, Canada. The main focus of her research was on a new generation of Startup Instrumentation for CANDU reactors.
- Masters in Science in Electrical Communications (2002) from University of Colorado in Boulder, USA. The main focus of her research was on data processing in broadband communications and identification/prevention of vulnerability in data transmission, storage and processing.
- Batchelor of Electrical Engineering with Honours (1997) from Azerbaijan Technical University, USSR.

Since 2009 she is employed by Bruce Power Plant Engineering where she was responsible for providing technical expertise in daily monitoring and troubleshooting of Shutdown System 1 and 2, Reactor Regulating System and Startup Instrumentation System. She was actively involved in return to service of Bruce Units 1 and 2, providing support for system commissioning, testing and quality assurance for I&C instrumentation and components used for monitoring of critical core parameters.

For the past 2 years she has been working in Reactor Safety Division performing computer simulations for optimal fueling strategy, Start-Up and power maneuvering, and monitoring licensing and safety limits compliance, as well as providing technical evaluations and advice in a number of major work areas (safety analysis, fuel channel behavior, structural integrity, and fitness for service), in support of the safe operation of Bruce reactors.

Emmanuel Boafo

Ph.D. student in the University of Ontario Institute of Technology (UOIT), from Sep-2014. He got his Master of Philosophy in Nuclear Engineering in 2010, where he conducted basic research in the area of Basic Reactor Physics, Heat Transfer and Fluid Flow, Types of Reactors, Reactor Dynamics, Reactor statics, Fuel Management, and Engineering Mathematics, from School of Nuclear and Allied Sciences, University of Ghana (University) Accra (Ghana). In 2006, he got his Bachelor of Science in Mathematics. From 2010 till 2014 he worked as a research scientist in Ghana Atomic Energy Commission, Ghana. Throughout his career, he has published 6 articles in the area of nuclear physics.

Daniel Bondarenko
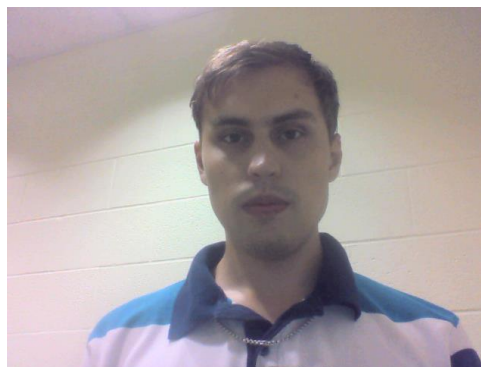
Daniel Bondarenko is an Electrical Engineering Master student at UOIT, and a research assistant at ESCL. He has been engaged in discovering the polarization effects of magnetic field on the air-fuel mixtures, design and testing of the Fault Diagnostic System, creation of the systematic foundations of intelligent utility meter operation, and co-authored a paper on the smart meters. He was also was involved in the creation and analysis of an Energy Semantic Network Model, for heat performance evaluation of a building facility. The research position lead him to become involved with studies of nuclear fusion, particularly in regard to plasma temperature measurement and plasma Particle-In-Cell simulation. Played a role in organizing the IEEE conference on the Smart Energy Grid Engineering in 2013.