



## ICIT 2021 Special Session

# Advanced Control of Grid-Connected Inverters for Distributed Generation and Power Quality

### Session Organizers:



**Prof. Hadi Y. Kanaan**

[hadi.kanaan@usj.edu.lb](mailto:hadi.kanaan@usj.edu.lb)

Full-time Professor, Head of the Department of Electrical and Mechanical Eng. Saint-Joseph University of Beirut, Faculty of Engineering (ESIB), Lebanon  
IEEE Number: 41239423

**Hadi Y. Kanaan** (S'99-M'02-SM'06) received the diploma in electromechanical engineering from Saint-Joseph University of Beirut, the Ph.D. degree in electrical engineering from the *Ecole de Technologie Supérieure* (ETS), Montreal, Canada, and the *Habilitation à Diriger des Recherches* (HDR) from the *Université de Cergy-Pontoise*, Paris, France, in 1991, 2002 and 2009 respectively. He is currently a Full-Professor and Head of the Electrical and Mechanical Department at the *Ecole Supérieure d'Ingénieurs de Beyrouth* (ESIB) of Saint-Joseph University of Beirut, which he joined in 2001. He is a visiting researcher at ETS since 2004, and associate member of the Canada Research Chair in Energy Conversion and Power Electronics since 2001. His research interests concern modeling and control of switch-mode converters, modern rectifiers, power factor correction, active power filters, and grid-connectivity of renewable energy systems. He is an author of 1 book, 2 book chapters, 1 patent and more than 200 technical papers published in international journals and conferences. He is an Associate Editor of the *IEEE Transactions Industrial Electronics*, and member of the *IEEE Power Electronics Society* (PELS), *Industrial Electronics Society* (IES) and *Industry Applications Society* (IAS). He is also the treasurer of the *IEEE Lebanon Section* and the Vice-Chair of the *IE/PE/CAS/PEL Joint Chapter* in Lebanon.



**Prof. Kamal Al-Haddad**

[kamal.al-haddad@etsmtl.ca](mailto:kamal.al-haddad@etsmtl.ca)

Ecole de Technologie Supérieure, Montreal, Canada  
IEEE Number: 02253045

**Kamal Al-Haddad** (S'82-M'88-SM'92-F'07) received the B.Sc.A. and M.Sc.A. degrees from the University of Québec à Trois-Rivières, Canada, in 1982 and 1984, respectively, and the Ph.D. degree from the Institute National Polytechnique, Toulouse, France, in 1988. Since June 1990, he has been a Professor with the Electrical Engineering Department, *École de Technologie Supérieure* (ETS), Montreal, QC, where he has been the holder of the Canada Research Chair in Electric Energy Conversion and Power Electronics since 2002. He has supervised more than 130 Ph.D. and M.Sc.A. students working in the field of power electronics. He is a Consultant and has established very solid link with many Canadian industries working in the field of power electronics, electric transportation, aeronautics, and telecommunications. Dr Al-Haddad and his team have transferred 23 technologies to the industry in the form of industrial product and integrated technologies along with 3 patents. He has coauthored more than 500 transactions and conference papers. His fields of interest are in high efficient static power converters, harmonics and reactive power control using hybrid filters, switch mode and resonant converters including the modeling, control, and development of prototypes for various industrial applications in electric traction, renewable energy, power supplies for drives, telecommunication, etc. Prof. Al-Haddad is a fellow member of the Canadian Academy of Engineering. He is IEEE- IES President Elect, Associate editor of the *Transactions on Industrial Informatics*, and IES Distinguished Lecturer. In 2015, he received the prestigious the Dr.-Ing. Eugene Mittelmann Achievement Award.

**Prof. Hasan Komurcugil**[hasan.komurcugil@emu.edu.tr](mailto:hasan.komurcugil@emu.edu.tr)

Full-time Professor, Department of Computer Engineering  
Eastern Mediterranean University, Famagusta, Via Mersin 10, Turkey  
IEEE Number: 04229068

**Hasan Komurcugil (S'94, M'99, SM'12)** received the B.Sc., M.Sc. and Ph.D. degrees in Electrical and Electronic Engineering from the Eastern Mediterranean University (EMU), Famagusta, Mersin 10, Turkey, in 1989, 1991, and 1998, respectively. In 1998, he joined the Computer Engineering Department, EMU, as an Assistant Professor, where he became an Associate Professor and a Professor in 2002 and 2008, respectively. From 2004 to 2010, he was the Head of Computer Engineering Department, EMU. In 2010, he played an active role in preparing the department's first self-study report for the use of Accreditation Board for Engineering and Technology (ABET). During 2010-2019, he was a Board Member of higher education, planning, evaluation, accreditation and coordination council (YODAK) in North Cyprus. Currently, he is with the Computer Engineering Department, EMU. His research interests include power electronics and innovative control methods for power converters. Prof. Komurcugil received Best Presentation Recognitions at the 41<sup>st</sup> and 42<sup>nd</sup> Annual Conference of the IEEE Industrial Electronics Society in 2015 and 2016. He is a member of IEEE Industrial Electronics Society. Also, as Guest editor, he organized two SSs entitled "Identification and Observation Informatics for Energy Generation, Conversion and Applications" and "Recent Advances on Sliding Mode Control and Its Applications in Modern Industrial Systems" in IEEE Transactions on Industrial Informatics. Prof. Komurcugil is an Associate Editor of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS and IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS.

**Mr. Mohammad Sharifzadeh**[mohammad.sharifzadeh@ieee.org](mailto:mohammad.sharifzadeh@ieee.org)

Ecole de Technologie Supérieure, Montreal, Canada  
IEEE Number: 93852799

**Mohammad Sharifzadeh** is currently pursuing his PhD in power electrical engineering at the Ecole de Technologie Supérieure (ETS), University of Quebec, in Montreal, Canada, as a member of Groupe de Recherche en Électronique de Puissance et Commande Industrielle (GRÉPCI). His research interests include power electronics multilevel converters; topologies, switching techniques particularly Selective Harmonic Elimination/Mitigation techniques and advanced control of multilevel voltage source inverters in grid connected applications as well as optimization methods applications in power system.

**Dr. Fadia Sebaaly**[fadia\\_sebaaly@hotmail.com](mailto:fadia_sebaaly@hotmail.com)

Ecole de Technologie Supérieure, Montreal, Canada  
IEEE Number: 92106046

**Fadia Sebaaly (S'14–M'16)** received the B.Sc. degree in electrical engineering from the Faculty of Engineering (II), Lebanese University, Beirut, Lebanon, in 2009, and the M.Sc. degree in electrical engineering in 2012, and the Ph.D. degree in electrical engineering/power electronics in 2016 both from the Faculty of Engineering-Ecole Supérieure d'Ingénieurs de Beyrouth, Saint-Joseph University, Beirut. She also received the Doctoral degree from the School of Science and Technology, Lebanese University. In summer 2014 and 2015, she was a Trainee with the Groupe de Recherche en Electronique de Puissance et Commande Industrielle, Ecole de Technologie Supérieure, University of Quebec, Montreal, QC, Canada. She is currently a Postdoctoral Researcher with the Faculty of Engineering-Ecole Supérieure d'Ingénieurs de Beyrouth, Saint-Joseph University. Her research interests include power electronics multilevel converters topology, control (predictive and sliding mode controllers) and modulation techniques, power quality, and their applications into renewable energy systems.



### **-Technical Outline of the Session and Topics:**

Renewable sources, such as photovoltaic panels, wind generators and fuel cells, are usually connected directly to the grid for cogeneration. This connection is made through power electronics interfaces that should ensure high stability, voltage regulation, power flow control, and low electromagnetic emission, along with high power density, low cost and high reliability. In some applications where high power level is required, the switching frequency of the power semiconductors is limited and the use of multilevel or interleaved converters becomes mandatory in order to get an acceptable power quality. This session addresses the issues of advanced control techniques applied to such converters to improve their performance, efficiency, reliability and cost-effectiveness.

Topics of interest include, but are not limited to:

- Advanced control of multilevel inverters
- Advanced control of power electronics in DC grids
- Grid-connectivity control requirements
- Control of paralleled or interleaved topologies
- Modeling and model-based control of switch-mode power converters
- Optimal control in hybrid cogeneration systems
- Predictive control of power converters
- Intelligent control of power converters
- Direct power control of power converters
- Power quality control in renewable energy systems
- New PWM techniques for power electronics control
- Real-time control and simulations of high power converters

### **IEEE IES Technical Committee Sponsoring the Special Session:**

TCPE (Control in Power Electronics subcommittee)