CONTROL FOR GRID-FRIENDLY POWER CONVERTER SYSTEMS

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SCOPE AND BENEFITS

Challenges are witnessed in practical cases with a high penetration of renewables, leading to the continuous revolution of grid-connection requirements. Power converter systems are thus becoming more active in the grid regulations and now are more being integrated with storages. This is referred to as "Grid-Friendly Power Converter Systems." In addition, in recent years, grid-connected power systems are also controlled to mimic the behavior of conventional synchronous generators to provide inertial (i.e., virtual inertial control). In light of the above, we intend to address the challenges in the control for grid-friendly power converter systems in terms of flexible active power regulation and virtual inertial control so that to further pave the way of exploiting and utilizing cost-effective renewable energy systems.

CONTENTS

The tutorial will cover the following topics:

Part 1 – Flexible Active Power Control

- **Power Electronic Technologies**
  - Motivation and background
  - Power electronics technology development
  - General power converter control
- **Flexible Active Power Control**
  - Grid codes revolution – demands for smart inverters
  - Constant (absolute) power generation control
  - Delta power control (power reserve control)
  - Power ramp-rate control

Coffee Break

Part 2 – Emerging Inertia Control

- **Power System Inertia**
  - Basics of power system inertia
  - Challenges of future low inertia power system
  - Conventional ways of inertia enhancement
- **Emerging Inertia Control Techniques**
  - Inertia Emulation by wind turbines
  - Virtual inertia provided by dc-link capacitors
  - Virtual inertia provided by batteries

Final Q&A and wrap up

Schedule is as follows:

Monday, 17 September 2018 - Tutorial day (Location: RTU, Riga, Latvia)

14:00 - 15:30	Tutorials Part 1 – Flexible Active power Control
15:30 - 16:00	Coffee break
16:00 - 17:30	Tutorials Part 2 – Emerging Inertia Control

WHO SHOULD ATTEND

The tutorial is intended for audiences in the field of power electronics and power electronics-based power systems, who are looking for advanced control solutions to flexibly integrate power converter systems (renewable energy systems). Researchers and engineers who seek for the basic knowledge for the active power control in power electronic converters are also welcomed. Prerequisite is basic power electronics and general control theory.

Technical Level: The tutorial is for intermediate and advanced audiences.

ABOUT THE INSTRUCTORS

Frede Blaabjerg (F'03) is currently a Professor with the Department of Energy Technology and the Director of Center Of Reliable Power Electronics (CORPE), Aalborg University, Denmark. He has intensive research work on power electronics and its applications in motor drives, wind turbines, PV systems, harmonics, and the reliability of power electronic systems. He has held more than 300 lectures national and international, most of them in the last decade are invited and as keynotes at conferences, covering various topics on power electronics, including the reliability. He was a Distinguished Lecturer for the IEEE Power Electronics Society from 2005 to 2007 and for the IEEE Industry Applications Society from 2010 to 2011. He has contributed more than 800 journal and conference papers, many of which in the last four years are relevant to the reliability of power electronic components, converters, and systems. Dr. Blaabjerg received the IEEE William E. Newell Power Electronics Award in 2014, the IEEE PELS Distinguished Service Award in 2009, the Outstanding Young Power Electronics Engineer Award in 1998, and 15 IEEE Prize Paper Awards. He served the Editor-in-Chief of the IEEE Transactions on Power Electronics from 2006 to 2012.

Yongheng Yang (S'11-M'15-SM'17) received the B.Eng. degree from Northwestern Polytechnical University, China, in 2009 and the Ph.D. degree from Aalborg University,

Denmark, in 2014. He was a postgraduate student with Southeast University, China, from 2009 to 2011. In 2013, he was a Visiting Scholar at Texas A&M University, TX, USA. Since 2014, he has been with the Department of Energy Technology, Aalborg University, where currently he is an Associate Professor. His research includes grid integration of renewable energies, power electronic converter design, analysis and control, and reliability in power electronics. Dr. Yang served as a Guest Associate Editor of IEEE Journal of Emerging and Selected Topics in Power Electronics and a Guest Editor of Applied Sciences. He is an Associate Editor of CPSS Transactions on Power Electronics and Applications.

Yi Tang (S'10-M'14) received the B.Eng. degree in electrical engineering from Wuhan University, Wuhan, China, in 2007 and the M.Sc. and Ph.D. degrees in power engineering from the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, in 2008 and 2011, respectively. From 2011 to 2013, he was a Senior Application Engineer with Infineon Technologies Asia Pacific, Singapore. From 2013 to 2015, he was a Postdoctoral Research Fellow with Aalborg University, Aalborg, Denmark. Since March 2015, he has been with Nanyang Technological University, Singapore as an Assistant Professor. He is the Cluster Director of the advanced power electronics research program at the Energy Research Institute @ NTU (ERI@N). Dr. Tang received the Infineon Top Inventor Award in 2012, the Early Career Teaching Excellence Award in 2017, and four IEEE Prize Paper Awards. He serves as an Associate Editor of the IEEE Journal of Emerging and Selected Topics in Power Electronics (JESTPE).