Information

PowerTech 2019 tutorials are taking place on **Sunday 23rd June.**

The **agenda** is the following:

time	Room A	Room B	Room C	Room D	Room E
08:30-09:00	REGISTRATION				
09:00-10:30	T1 - part 1	T2 - part 1	T3 - part 1	T4 - part 1	T5 - part 1
10:30-10:45	COFFEE BREAK				
10:45-12:15	T1 - part 2	T2 - part 2	T3 - part 2	T4 - part 2	T5 - part 2
12:15-12:30	Q&A	Q&A	Q&A	Q&A	Q&A
12:30-13:30	LIGHT LUNCH (included in the tutorial registration fee)				
13:30-15:00	T1 - part 3	T2 - part 3	T3 - part 3	T4 - part 3	T6 - part 1
15:00-15:15	COFFEE BREAK				
15:15-16:45	T1 - part 4	T2 - part 4	T3 - part 4	T4 - part 4	T6 - part 2
16:45-17:00	Q&A	Q&A	Q&A	Q&A	Q&A

Tutorial T1 (Full day)

The Smart Transformer: Impact on the Electric Grid and Technology Challenges

Organizers:

- Marco Liserre, Chair of Power Electronics, Kiel University, ml@tf.uni-kiel.de
- Giovanni De Carne, Chair of Power Electronics, Kiel University, gdc@tf.uni-kiel.de
- Rongwu Zhu, Chair of Power Electronics, Kiel University, rzh@tf.uni-kiel.de
- Ali Kazerooni, WSP, Ali.Kazerooni@wsp.com
- Anthony Donoghue, SP Energy Networks, adonoghue@spenergynetworks.co.uk

Abstract:

The increasing connection of renewables and new loads is challenging the distribution grids. For overcoming actual and foreseen challenges, a new concept, with the capability to form intelligent grid nodes, is proposed: the "Smart Transformer". The Smart Transformer is a power electronics-based transformer, aiming not only to adapt the voltage level from MV to LV grids but also providing ancillary services to the grid. In order to exploit its capability, the ST requires combining power system aspects and power electronics constraints, resulting in new requirements and challenges. This tutorial introduces the Smart Transformer concept and takes into account power system considerations as well as power electronics knowledge. ST architectures and topologies, basic controller designs and innovative concepts for increasing the availability are introduced. Hardware, control and grid connection requirements are described considering the matured industrial experience.

The Project will summarize the results of EU ERC Consolidator Grant Project "HEART" of Kiel University and OFGEM-funded project "LV-ENGINE" of SP Energy Networks, leading to testing the Smart Transformer technology in the field.

Structure:

08:30-09:00	**Registration**
09:00-10:30	**From the Solid-State-Transformer (SST) to the Smart Transformer** ()
10:30-10:45	Coffee break
10:45-12:15	**The Smart Transformer in the distribution grid: LV-ENGINE project** ()
12:15-12:30	Questions and Answers
12:30-13:30	Light lunch
13:30-15:00	**The Smart Transformer: a grid-tailored Solid-State-Transformer** ()
15:00-15:15	Coffee break
15:15-16:45	**ST virtuous loop: identify the LV-grid, control it, offer services to the MV-grid** ()
16:45-17:00	Questions and Answers

Tutorial T2 (Full day)

Probabilistic methods for power system management: state of the art, challenges and perspectives

Organizers:

- Andrea Pitto, Ricerca sul Sistema Energetico – RSE S.p.A.,andrea.pitto@rse-web.it
- Emanuele Ciapessoni, Ricerca sul Sistema Energetico – RSE S.p.A.,emanuele.ciapessoni@rse-web.it
- Pierre Henneaux, Université libre de Bruxelles, Pierre.Henneaux@ulb.ac.be
- Aydogan Ozdemir, Istanbul Technical University, ozdemiraydo@itu.edu.tr
- Ricardo Jorge Bessa, INESC TEC,ricardo.j.bessa@inesctec.pt
- Louis Wehenkel, Efthymios Karangelos

Abstract:

The increasing uncertainties in power systems due to the growing penetration of renewables and to market mechanisms as well as the increasing frequency of extreme weather events due to climate changes are major drivers for the application of probabilistic methods in a broad spectrum of activities aiming to assure the continuous operation of power systems: from long-term system development, through mid-term asset management towards short-term operational planning and real-time operation.

The tutorial presents an overview of state-of-art probabilistic methods for the planning and the operation of both transmission and distribution systems, taking into account the uncertainties due to growing penetration of renewables (which need accurate probabilistic modeling for decision-aid problems under risk) as well as the occurrence of extreme contingencies triggered by natural threats. The drawbacks and the limits of conventional methods are discussed and the results of case studies on real world systems are described. After demonstrating the need for probabilistic methods, the tutorial highlights the current barriers for uncertainty modeling in current decision-aid problems under risk and for a practical implementation of these probabilistic risk based approaches in control center environment.

Structure:

08:30-09:00	**Registration**
09:00-10:30	**Introduction** (Emanuele Ciapessoni) **Probabilistic reliability analysis for transmission planning** (Pierre Henneaux) **Reliability evaluation of active distribution systems** (Aydogan Ozdemir)
10:30-10:45	Coffee break
10:45-12:15	**Probabilistic methods for risk-based power system operation** (Andrea Pitto)
12:15-12:30	Questions and Answers (Emanuele Ciapessoni)
12:30-13:30	Light lunch
13:30-15:00	**Probabilistic forecasting of renewable energy in decision aid problems under risk** (Ricardo Jorge Bessa)
15:00-15:15	Coffee break
15:15-16:45	**Challenges for the practical implementation of probabilistic risk-aware reliability management** (Louis Wehenkel, Efthymios Karangelos)
16:45-17:00	Questions and Answers (Emanuele Ciapessoni)

Tutorial T3 (Full day)

Computational Intelligence in Power System Applications

Organizers:

- Kalyanmoy Deb, Michigan State University, kdeb@egr.msu.edu
- Marco Mussetta, Politecnico di Milano, marco.mussetta@polimi.it
- Emanuele Ogliari, Politecnico di Milano, emanuelegiovanni.ogliari@polimi.it

Abstract:

Module A: Machine Learning for power forecasting

The variability of renewable energy represents a huge challenge in the integrated electricity systems: power production forecasts can help reducing the amount of operating reserves needed for the system, finally reducing the balancing costs. While physical predition methods strongly rely on the accuracy of the weather forecast, Artificial Neural Networks are based on the learning process of the underlying models and are commonly referred to as a "data-driven" or "black box" approaches. In fact, they need historical data that, after being collected, are used to infer a general trend and behavior in order to predict future output of the power plant. Hybrid methods, consisting in any combination of the physical-based approach and Machine Learning can guarantees the highest level of accuracy when adopted to the power forecast of RES.

Module B: Evolutionary Multi-Criterion Optimization with Case Studies on Power Dispatch Problem Solving

Evolutionary optimization methods, proposed in early sixties and used in practice since eighties, are population-based algorithms which are easily customizable to suit different problem-solving tasks. Evolutionary multi-criterion optimization (EMO) algorithms, proposed since early nineties, revolutionized the solution of problems having multiple conflicting objectives. Starting with two and three-objective problems, EMO researchers have devised algorithms for solving up to 15-objective problems and applied to many engineering and practical problems. In this tutorial, we shall present a step by step account of the growth of EMO field by describing the principles of multi-criterion optimization, some key algorithms, and recent advances in the field. Case studies on power dispatch problem for single and multiple criteria aspects and its static and dynamic versions will be presented.

Structure:

08:30-09:00	**Registration**
09:00-10:30	**Module A: Machine Learning techniques for power forecasting** (Marco Mussetta)
10:30-10:45	Coffee break
10:45-12:15	**Module A: Hybrid methods for power forecasting** (Emanuele Ogliari)
12:15-12:30	Questions and Answers
12:30-13:30	Light lunch
13:30-15:00	**Module B: Evolutionary Multi-Criterion Optimization with Case Studies on Power Dispatch Problem Solving – part 1** (Kalyanmoy Deb)
15:00-15:15	Coffee break
15:15-16:45	**Module B: Evolutionary Multi-Criterion Optimization with Case Studies on Power Dispatch Problem Solving – part 2** (Kalyanmoy Deb)
16:45-17:00	Questions and Answers

Tutorial T4 (Full day)

Power System Optimization Modeling in GAMS

Organizer:

- Alireza Soroudi, Energy Institute UCD, Alireza.soroudi@ucd.ie

Abstract:

The optimal decision making is a key part of any engineering problem. The General Algebraic Modeling System (GAMS) can be used to solve various power system operation and planning optimization problems. This tutorial is to provide the audience with a comprehensive overview of the GAMS capabilities solving for basic/advanced power system optimization problems. The theoretical background as well as the application examples and test case studies will be covered. It is suitable for dedicated and general audiences including power system professionals as well as researchers and developers from the energy sector and electrical power engineering community and will be helpful to undergraduate and graduate students.

Structure:

08:30-09:00	**Registration**
09:00-10:30	**Basic GAMS features** **Economic dispatch problem**
10:30-10:45	Coffee break
10:45-12:15	**Dynamic Economic Dispatch** **Energy Storage Dispatch**
12:15-12:30	Questions and Answers
12:30-13:30	Light lunch
13:30-15:00	**DC/AC- Optimal Power Flow in GAMS**
15:00-15:15	Coffee break
15:15-16:45	**PMU allocation problem** **Uncertainty modeling using GAMS**
16:45-17:00	Questions and Answers

Tutorial T5 (Half day – morning)

Infrastructure planning under uncertainty: flexibility, resilience and multi-energy systems application

Organizers:

- Mathaios Panteli, The University of Manchester, mathaios.panteli@manchester.ac.uk
- Eduardo Alejandro Martínez Ceseña, The University of Manchester, alex.martinezcesena@manchester.ac.uk
- Rodrigo Moreno, Universidad de Chile and Imperial College London, rmorenovieyra@ing.uchile.cl,
- Pierluigi Mancarella, The University of Manchester and The University of Melbourne, p.mancarella@manchester.ac.uk

Abstract:

Traditional investment planning practices are becoming less effective in the energy sector as uncertainties increase due to the integration of renewable energies and low carbon technologies (e.g., electric vehicles), and the increasing frequency and severity of extreme events due to climate change (e.g., droughts, earthquakes, etc.). To tackle these challenges, new tools that properly capture uncertainty and extreme events are required to develop more resilient and adaptive energy systems by capitalizing on emerging smart solutions based on active network management and different energy vectors (e.g., electricity, heat, gas and water). This tutorial provides an overview of recently developed state-of-the-art investment planning tools which explicitly address uncertainty (e.g., decision and real options theory) related to highly uncertain system evolution and low probability high impact events. Real world studies from international research projects are used to demonstrate the tools with distribution and transmission networks, community multi-energy systems, and integrated water-energy mega systems.

Structure:

08:30-09:00	**Registration**
09:00-10:30	**Infrastructure planning under uncertainty** – The different levels of uncertainty – Decision theory, robust and flexible decisions – New stochastic programming approaches **Infrastructure planning considering uncertain extreme events** – Differences between reliability and resilience – Metrics: The resilience trapezoid – Tools: Probabilistic impact assessment and optimization via simulation – Novel probabilistic operational and planning methods
10:30-10:45	Coffee break
10:45-12:15	**Future and already emerging energy systems** **Infrastructure planning for flexible and adaptive energy systems:** – Smart distribution networks: Flexible active network management to accommodate emerging low carbon technologies – Building and community multi-energy systems: Use of multi-vector demand side flexibility to cope with uncertain demand growth, price variations and integration of low carbon technologies **Infrastructure planning for resilient energy systems:** – Resilient energy systems: development of optimal portfolios considering asset and non-asset solutions for stronger and smarter, more flexible transmission networks – Water-Energy-Environment Mega systems: Planning future integrated mega systems in developing countries in light of climate change threats
12:15-12:30	Questions and Answers

Tutorial T6 (Half day – afternoon)

Increasing the PV Hosting Capacity of Distribution Networks: The role of Smart Inverters and Storage

Organizers:

- Luis (Nando) Ochoa, The University of Melbourne and The University of Manchester, luis.ochoa@unimelb.edu.au
- Andreas Procopiou, The University of Melbourne, andreas.procopiou@unimelb.edu.au

Abstract:

Distribution Network Operators (DNOs) in many countries are finding it challenging to allow residential customers to continue to install photovoltaic (PV) systems due to the potential technical impacts resulting from high penetrations. To remove these barriers, speed up connection times, and reduce costs, it is crucial for DNOs to increase the PV hosting capacity of their low and medium voltage networks. Adequately exploiting the capabilities of smart inverters and residential battery energy storage systems will be key. This half-day tutorial will present and discuss different aspects required to assess the residential PV hosting capacity of distribution networks. Furthermore, it will explain and demonstrate the benefits but also the potential challenges from exploiting the capabilities of smart inverters (Volt-Watt, Volt-var, export limits) and residential storage systems to increase hosting capacity. Real case studies from Australia will be used to demonstrate the quantification of PV hosting capacity considering potential strategies to make the most of smart inverters and storage.

Structure:

13:00-13:30	**Registration**
13:30-15:00	**Part 1. Distribution Networks and Solar PV** (Ochoa) – PV Hosting Capacity, Challenges, and Potential Solutions – Modelling of Distribution Networks **Part 2a. PV Hosting Capacity and PV Inverters** (Procopiou) – Estimating Hosting Capacity with Stochastic Approaches
15:00-15:15	Coffee break
15:15-16:45	**Part 2b. PV Hosting Capacity and PV Inverters** (Procopiou) – Increasing PV Hosting Capacity with Smart Inverter Functions and Active Control – Case Studies with French and Australian Networks **Part 3. PV Hosting Capacity and Residential Battery Storage Systems** (Ochoa) – Limitations of Off-the-shelf Batteries and Solutions with Advanced Control – Case Studies with Australian Networks
16:45-17:00	Questions and Answers

Information

Conference Location

Politecnico di Milano, Campus Bovisa
Via Lambruschini, 4
20156 Milano (MI)

The Campus is located in the north side of Milano and can be easily reached by urban trains from the city center. A new building equipped with a modern Conference Hall for more than 400 attendees has been recently delivered. In the same building and in the neighboring ones, several smaller conference rooms (200 attendees each) as well as spaces for posters presentation and exhibition are also available.

Travel Information

GETTING TO MILANO

As you're likely to land in Malpensa, in Linate or in Orio al Serio airport, you can plan how to reach Milano following these suggestions.
If you land at **Linate Airport**:
Air Bus to Centrale Railway Station: www.atm-mi.it
Bus no. 73 to Piazza San Babila: www.atm-mi.it

If you land at **Malpensa Airport**:
Malpensa Express Train to Cadorna Railway Station: www.malpensaexpress.it
Malpensa Shuttle to Centrale Railway Station: www.malpensashuttle.it

If you land at **Orio al Serio Airport**:
Terravision Bus to Centrale Railway Station: www.terravision.eu/milan_bergamo.html
Orio shuttle to Centrale Railway Station: www.orioshuttle.com

GETTING TO THE BOVISA CAMPUS

From the city centre, get to one of the following subway stops: **Porta Venezia** (red line), **Repubblica** (yellow line) or **Garibaldi** (green line), take one of the railways named "**Passante ferroviario**" and get off at either **Bovisa Politecnico** or **Villapizzone** stations.

Also, you can reach **Cadorna** subway stop (green and red line), go to its railway station, take any train that leaves from there (except Malpensa Express) and get off at **Bovisa Politecnico** stop. Once you get out of Bovisa railway station, turn right to reach the Engineering Campus (Via Lambruschini 4).

Timings

From the city center (subway stops):

- Cadorna (green&red line) - 6 min
- Garibaldi (green line) - 11min
- Repubblica (yellow line) – 14 min
- Porta Venezia (red line) – 16 min
- Centrale (green&yellow) - 16 min

From Malpensa airport:

- Direct connection with the airport every 30 min – 32 min