

Tutorial Programme

One day tutorial – Protecting DC and Associated Networks

Chair: Rannveig Loken, *Statnett, Norway*

Synopsis

The tutorial this year focuses on Protection of the DC and Associated Network. It begins with some lessons learned related to HVDC projects and continues with an introduction to Transient Analysis of Multi-terminal HVDC VSC-Based Networks during DC faults. We will then look at the protection engineers view on the Supergrid. In the afternoon, we will look at the HVDC Circuit Breakers, with a focus for the protection engineer. Then we will continue with some network studies related to Continuous assessment of the protection security for modern grids. The Tutorial continues with Protection of low voltage DC systems that focus on new scheme of protection algorithms, challenge of protecting LV DC circuits and some review of recent developments and research. The tutorial will close with Protection of AC and DC rail network, with overview of system protection, some challenges in traction protection, application of IEC 61850 to traction systems, and harmonisation of traction protection principles

The tutorial will take place on the Monday preceding the main activities of the conference.

Tutorial Programme

09:00 *Registration and refreshments*

09:30 **HVDC projects within TenneT and some lessons learned**
Peter Leushuis, TenneT

10:00 **Transient analysis of multi-terminal HVDC VSC-based networks during DC faults**
Alex Alefragkis, TenneT

10:30 *Refreshments*

11:00 **The protection engineers view on the Supergrid**
Alex Apostolov, Omicron Electronics, USA

12:00 *Lunch*

13:00 **HVDC circuit breakers; what, why and when**
Andrzej Adamczyk, Alstom

13:45 **Continuous assessment of the protection security is indispensable for modern grids**
Thomas Bopp, Siemens

14:30 **Protection of low voltage DC systems**

- Requiring a new scheme of protection algorithms
- The challenge of protecting LV DC circuits
- The fuse
- LV moulded case circuit breakers
- The DC Fuse
- Review of recent developments and research

Miles Redfern, University of Bath, UK

15:30 *Refreshments*

16:00 **Protection of AC and DC rail network**

- Overview of system protection
- Challenges in traction protection
- Application of IEC 61850 to traction systems
- Harmonisation of traction protection principles

Dave Hewings, Network Rail, UK
Martin Altmann, Siemens AG, Germany

17:00 **Welcome Drinks Reception**

19:00 **Close**

