



27th Nordic Insulation Symposium

June 13-15, 2022, NTNU, Trondheim, Norway

Program



Organizing Committee

Frank Mauseth	Chairman Norwegian University of Science and Technology Dept. of Electric Power Engineering Trondheim, Norway
Hans Edin	Division of Electromagnetic Engineering KTH – Royal Institute of Technology Stockholm, Sweden
Kari Lahti	Electrical Engineering Tampere University Tampere, Finland
Claus Leth Bak	Faculty of Engineering and Science Aalborg University Aalborg, Denmark

The symposium is an interdisciplinary Nordic forum for open discussion of ideas, research results and practical experience on electrical power insulation. It addresses itself to researchers and engineers working in research institutes, power industry and power supply and is also open for participants from outside the Nordic countries. Contributions from young researchers are particularly welcome.

www.nordis.org

Monday, 13 June 2022

08:15-09:00 Registration outside EL5, NTNU Gløshaugen

09:00-09:10 Opening by chairman Frank Mauseth

09:10-10:00 Invited speaker Dr. Tord Bengtsson

10:00-10:20 Coffee break

10:20-11:35 Session 1 – Discharges and harmonics

Session chair: Kari Lahti

Partial Discharge Behavior of Epoxy-Mica Insulation Systems under Superimposed AC and DC Voltage Stress

Thomas Linde¹, Karsten Backhaus¹, Stephan Schlegel¹, Sebastian Lengsfeld², Jonas Steffen², Joachim Krämer³, Klaus Schäfer⁴

¹Technische Universität Dresden, Germany, ²Fraunhofer Institute for Energy Economics and Energy System Technology, Karlsruhe, Germany. ³Krämer Energietechnik GmbH & Co., Germany, ⁴Flender GmbH, Germany

Possibilities of Conventional PD Measurements with Non-Sinusoidal Waveforms for Electric Vehicles

Maurizio Zajadatz, Laura Hörmann, Michael Suriyah, Thomas Leibfried
Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

On-site Measurement of Complex Waveforms on Transmission Network Components

Peter Wouters¹, Armand van Deursen¹, Jeroen van Oorschot¹, Marcel Hoogerman¹, Bernd van Maanen²

¹Eindhoven University of Technology Eindhoven, the Netherlands

²DNV Energy, Arnhem, the Netherlands

Non-contact Voltage Measurement Technique for On-Line Monitoring of Transient Overvoltages

G. D. P. Mahidhar, Patrick Janus, Hans Edin

KTH – Royal Institute of Technology, Stockholm, Sweden

Partial Discharge Evolution under Half-sine Voltage Excitation

G. Fu, Hans Edin, G. D. P. Mahidhar, Patrick Janus

KTH – Royal Institute of Technology, Stockholm, Sweden

11:35-12:30 Lunch - SiT Elektro

12:30-13:45 Session 2 – Cables 1

Session chairman: Claus Leth Bak, Aalborg Univ.

Review of Water Treeing in Polymeric Insulated Cables

Amar Abideen¹, Frank Mauseth¹, Øystein L. Hestad², Hallvard Faremo²

¹NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

²SINTEF Energy Research, Trondheim, Norway

Electric Field Modelling and Simulation of the High-voltage High-frequency Transformer Insulation Applied for Power Electronics Based on Circuit-field Coupling Analysis

Zhaoxin Wang, Claus Leth Bak, Filipe Faria da Silva, Henrik Sørensen

Aalborg University, Aalborg, Denmark

Longitudinal Breakdown Strength of Wet-mate Solid-Solid Interfaces at VLF and 50 Hz AC voltages

Erling Ildstad¹, Roger Dale², Emre Kantar²

¹NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

²SINTEF Energy Research, Trondheim, Norway

Hybrid Method for Numerical Implementation of Segmented Power Cable Conductors in Finite-element Based Ampacity Calculation

Henrik Strand¹, Espen Eberg¹, George J. Anders²

¹SINTEF Energy Research, Trondheim, Norway

²Technical University of Lodz, Poland

Pre-Breakdown Phenomena in Technical Air with and without C5-Fluoroketone for a Rod-Plane Gap

Fanny Skirbekk¹, Frank Mauseth¹, Hans Kristian Hygen Meyer²

¹NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

²SINTEF Energy Research, Trondheim, Norway

13:45-14:10 Coffee Break

14:10-15:25 Session 3 – Generator insulation

Session chair: Hans Edin

AC Breakdown Voltage of 50-Year-Old Service Aged Hydro Power Generator Stator Bars

Torstein Grav Aakre¹, Erling Ildstad²

¹SINTEF Energy Research, Trondheim, Norway

²NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

Advances in Interpreting On-Line Partial Discharge Test Results on Stator Windings

Mladen Sasic¹, Howard Sedding¹, Uros Stevanovic²

¹Qualitrol - Iris Power, (Canada)

²Sira-Kvina Kraftselskap, Norway

Use of Data-Driven Approaches for Defect Classification in Stator Winding Insulation

Emre Kantar¹, Jaime M. Cascallo², Torstein Grav Aakre^{1,2}, Nina M. Thomsen¹, Espen Eberg¹

¹SINTEF Energy Research, Trondheim, Norway

²NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

Comparison of Methods to Detect Thermomechanical Ageing of the Insulation System for Rotating High-Voltage Machines

Lena Elspaß¹, Stephan Schlegel¹, Hans Bärnklaus²

¹Technische Universität Dresden, Dresden, Germany

²VEM Sachsenwerk GmbH, Dresden, Germany

Multi-stress cyclic testing of Roebel Stator Bars for Hydropower

Espen Eberg, Emre Kantar, Torstein Grav Aakre

SINTEF Energy Research, Trondheim, Norway

18:00 - Symposium dinner and tour of Rockheim. Rockheim is Norway's National Museum of Popular Music, located at the harbour of Trondheim. (www.rockheim.no). We will get a guided tour before we enter the restaurant and enjoy the symposium dinner.

18:00 *Guided tour of Rockheim*

19:00 *Symposium dinner at Rockheim*

Tuesday 14 June 2022

09:00-10:30 Session 4 – Cables 2

Session chair: Frank Mauseth, NTNU

Selective PD Measurements on DC Cable Joints Using an HFCT-Balanced Circuit Arrangement

Bernhard Schober, Uwe Schichler

Graz University of Technology, Graz, Austria

MVAC XLPE Cables for MVDC - DC Conductivity of Plaque Samples During Temperature Changes

Patrik Ratheiser, Uwe Schichler

¹Graz University of Technology, Graz, Austria

²High Voltage Test Laboratory Graz Ltd., Graz, Austria

Efficient Sensitivity Calculation for Insulation Systems in HVDC Cable Joints

M. Greta Ruppert¹, Yvonne Späck-Leigsnering¹, Myriam Koch², Herbert De Gersem¹

¹Technische Universität Darmstadt, Darmstadt, Germany

²Technische Universität München, Munich, Germany

Breakdown Voltage of Polymeric HVDC Insulation at DC Stress and Superimposed Lightning Impulse Voltages

E. Ildstad, F. Mauseth and E.T. Olsen

NTNU, Dept. of Electrical Power Engineering, Trondheim, Norway

Lifetime of Oil-Impregnated Paper under Pulse Stress at Different Frequencies

Philip Mathew, Mohamad Ghaffarian Niasar

TU Delft, Delft, The Netherlands

10:15-10:35 Coffee Break

10:35-11:50 Session 5 – Measurements

Session chair: Hans Kristian Meyer, SINTEF Energy Research

Improvement and Uncertainty Evaluation of a 1 MV Lightning Impulse Measurement System

Lauri Aaltonen¹, Kari Lahti¹, Jari Hällström², Jussi Havunen²

¹Tampere University, Electrical Engineering, Finland

²VTT Technical Research Centre of Finland Ltd, Finland

The Usage of High Voltage Amplifiers to Set up Reference Calibrators for Combined and Impulse Voltages up to 1 kV

Mohamed Agazar, Hanane Saadeddine

LNE (Laboratoire National de métrologie et d'essais, France)

Universal Measuring Unit for High Voltage Measurements

A. Khamlichi^{1,2}, F. Garnacho^{1,2}, J. Rovira¹, P. Simón¹, T. García¹

¹LCOE-FFII, Spain

²Universidad Politécnica de Madrid, Spain

Optical Partial Discharge Measurement System

Ivan Semenov¹, Ingrid Gunheim Folkestad¹, Kaveh Niayesh¹, Dag Linhjell², Lars Lundgaard²

¹NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

²SINTEF Energy Research, Trondheim, Norway

Design and Verification of a Calculable Composite Voltage Calibrator

J. Havunen¹, J. Hällström¹, J. Meisner², F. Gerdinand², A.-P. Elg³

¹VTT Technical Research Centre of Finland Ltd, Espoo, Finland

²PTB Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

³RISE Research Institutes of Sweden, Borås, Sweden

11:50-13:00 Lunch

13:00-14:45 Session 6

Session chair: Erling Ildstad, NTNU

Streamer Propagation along Profiled Insulator Surfaces under Lightning Impulse Voltages

Hans Kristian Meyer¹, Robert Marskar¹, Henriette Bilbak², Frank Mausest², Michael Schueller³

¹SINTEF Energy Research, Trondheim, Norway

²NTNU, Dept. of Electric Power Engineering, Trondheim, Norway

³Eastern Switzerland University of Applied Sciences, Switzerland

Health Index Analysis of Transmission System Components

Soumya Thakur, Farah Deeba, Joachim Holbøll

Technical University of Denmark, Lyngby, Denmark

Characterization of Ion Transport Properties in Synthetic Ester Oil by Polarization Current and Dielectric Spectroscopy

A .Cremasco¹, E. Logakis², M. Curti¹, E. A. Lomonova¹

¹Eindhoven University of Technology, The Netherlands

²ABB Corporate Research Center, Switzerland

Diffusion Behavior of Greases in Interfaces in Organic Insulation Materials

Lucas Höfer, Marcel Heckel

PFISTERER Kontaktsysteme GmbH, Winterbach, Germany

DC-biased dielectric measurements using an existing frequency-domain spectroscopy (FDS) instrument and series battery

Nathaniel Taylor, Jing Hao

KTH Royal Institute of Technology, Stockholm

Characterization of Silicone Elastomers for Refractive Field Grading under Sinusoidal Voltages

Jun Ting Loh, Stefan Kornhuber

University of Applied Sciences Zittau/Görlitz, Germany

Novel Silicone Resin Binder and Compound for Thermally Demanding Applications

Jens Lambrecht, Konrad Hindelang, Markus Winterer

Wacker Chemie AG, Munich, Germany

14:45-15:00 Closing of the Symposium

Information on technical tour Wednesday 15th 2022.

15:00 Lab Tour of NTNU, Gløshaugen

- High voltage laboratories
- High current interruption lab
- National SmartGrid lab
- ...

Wednesday 15 June 2022

Technical tour

- 09:00-10:00 Bratsberg Hydro Power Plant
- 10:30-11:30 SINTEF Energy Lab
- Lunch
- 12:30-14:00 Siemens Energy, marine and subsea

Departure from Hotel Augustin is ca. 0835.

We will be in the Trondheim region, so those that need to catch a train/bus to the airport can do that without any further problems.

Presentation instructions:

Use PowerPoint or pdf as you wish.

Total time for each presentation is 15 min including questions.

Please upload the presentation to the pc in the auditorium in the break before your presentation, or send by email to nordis@iel.ntnu.no some time in advance.

Travel Information airport - Trondheim

From Trondheim Airport Værnes to City Center you can travel by:

- Train (www.sj.no). Price NOK 42. Ticket must be purchased before entering the train. Available through app, web and automats. The train ticket can also be used on local buses in Trondheim region (AtB). Jump of at Trondheim (Sentralstasjon).
- Local bus (AtB): Bus line 70 (www.atb.no) from bus stop close to the Shell Gas Station. Price NOK 42. Tickets must be purchased before entering the bus. The bus ticket can also be used on the train (SJ Nord) within the Trondheim region.
- Airport Bus Expresss (www.vaernesekspresen.no). Tickets are NOK 200 in the bus and NOK 189 brought online. Return tickets are NOK 360 and 338 respectively.
- Taxi; somewhere between NOK 800 and 1200, depending on time of day, weekend...

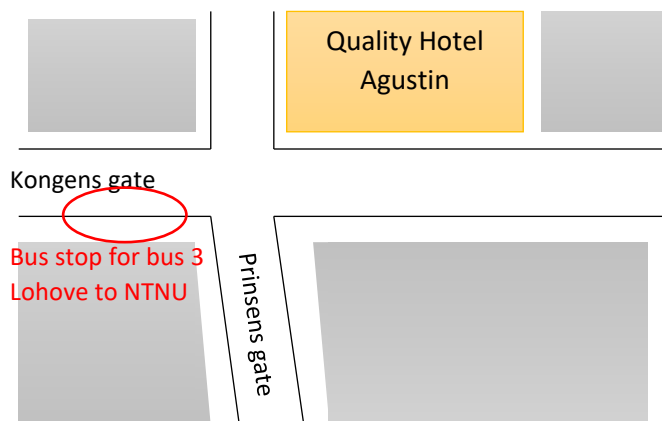
Symposium Venue NTNU Gløshaugen Campus

The Gløshaugen Campus can be reached by foot from, approx. 20 minutes' walk.

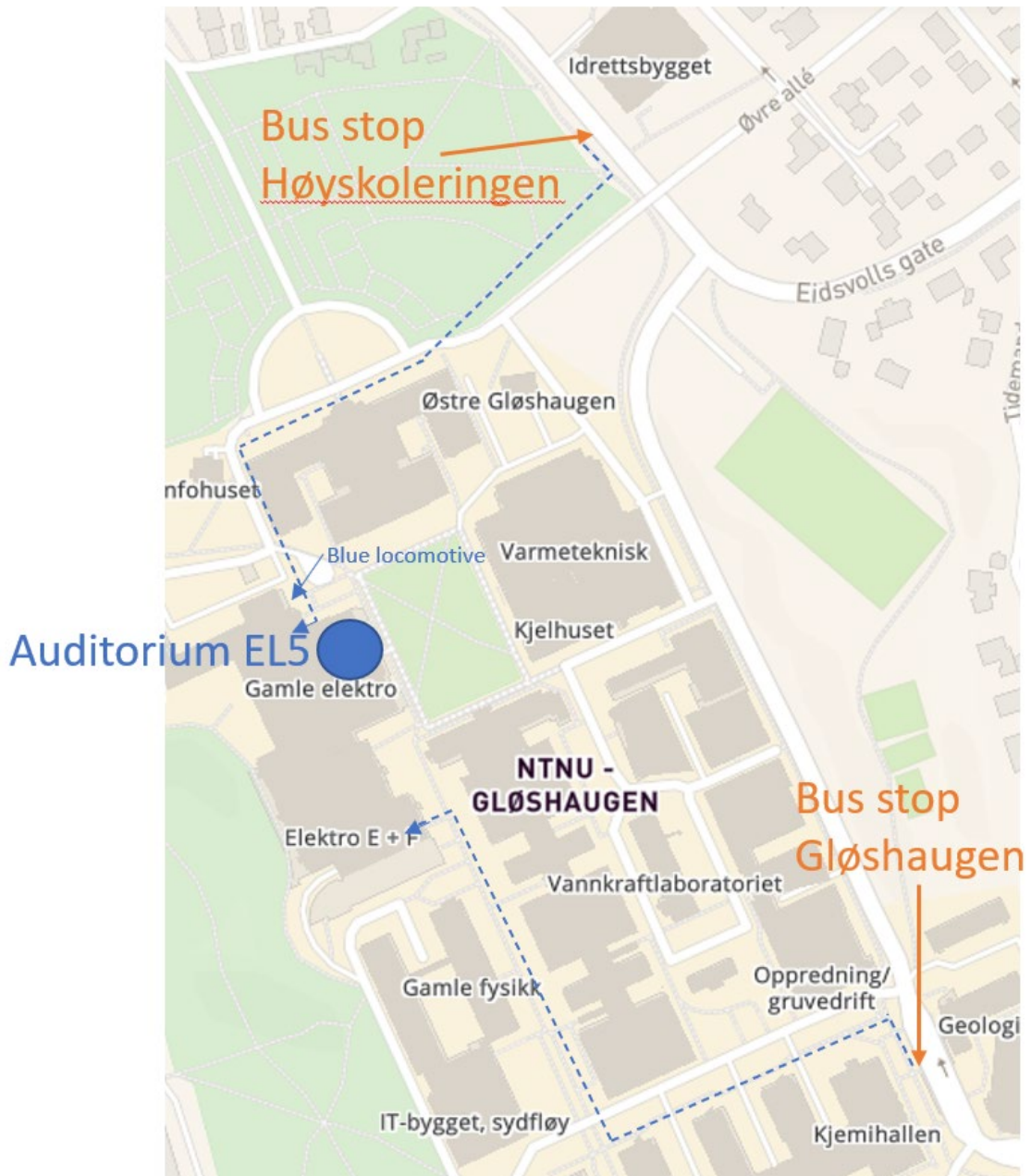
Google maps: tinyurl.com/nordis22 .

Alternatively, you can go by bus **3 Lohove**. Return with bus **3 Hallset**.

Tickets must be purchased before entering the bus.



You can exit either at Høykoleringen or Gløshaugen (see map next page)





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