<u>Monday June 23rd</u>

Partial Discharge Theory & Interpretation, 8 hrs - $325.00

The objective of this Partial Discharge tutorial is to understand basic PD theory as well as stator winding insulation systems and why they deteriorate. To learn how PD detection devices work, interpret the test data collected and relate the data to specific failure mechanisms, to enable you to plan stator winding maintenance.

Topics covered:

- Partial discharge phenomena and their causes in stator windings
- PD theory, PD detection, sensor installation, and calibration procedures
- Collection of off-line and on-line PD data
- PD characteristics of stator-failure mechanisms
- Case studies from continuous monitoring equipment and portable instruments

Instructor: Connor Chan

Connor Chan has been employed with Iris Power LP in Canada since 2001 and is currently a Rotating Machines Engineer. Prior to this position, he was a Field Service Manager. He received his BSc(Eng) degree in Electrical Engineering from the University of Hong Kong. Connor is a member of the Institute of Electrical and Electronics Engineers, the Institution of Engineering and Technology, UK, and the Institution of Engineers Australia, and is also a Chartered Engineer. He has co-authored a number of conference papers and journal articles.

Common Motor Failure Mechanisms and Operational Challenges, 8 hrs - $325.00

This tutorial will give an overview of common failure mechanisms that affect industrial motors including VFD driven motors. It will discuss electrical and mechanical failure mechanisms and problems.

Topics covered:

- Stator winding failures and PD activity
- Induction motor squirrel cage broken bars and end ring failures
- Synchronous motor starting cage failures
- Shorted turns and ground wall failures on wound field synchronous motor rotor windings
- Bearing failures
- Oil leaks
- Shaft and frame vibrations problems
- Shaft torsional problems
- Soft foot and insufficient foundation stiffness
- Cooler leaks

Instructors: Nick Stranges & Aaron Doyle

 Dr. Nick Stranges completed his Bachelor of Electrical Engineering degree at McMaster University in Hamilton, Ontario before obtaining an M. Eng and PhD in Electrical Engineering at McMaster's Power Research Laboratory. He worked in the Engineering Department of the Large Motor Technology group for General Electric in Peterborough, Ontario for 22 years prior to joining Andritz Hydro in 2018 as a Hydrogenerator Design Engineer. Dr. Stranges joined Iris Power in 2021.

Aaron Doyle completed Bachelor of Science (B.Sc.) in Mechanical Engineering from the University of Calgary Schulich School of Engineering in 2008 and became a recognized as a Professional Engineer (P.Eng.) by APEGA (Association of Professional

Engineers and Geoscientists of Alberta) in 2011. His specialty is vibration analysis including impact testing and modal analysis, Operating Deflection Shape (ODS) and Motion Amplification (MA) analyses, transient analysis for startups/shutdowns, dynamic balancing, torsional measurement and analysis.

Condition Based Maintenance of Turbo-Generators, 8 hrs - $325.00

This tutorial will cover basic design of turbogenerator, major core, stator and rotor winding failure mechanisms. Principles and benefits of most frequently used on-line monitors, such as partial discharge, end winding vibration, rotor flux and shaft voltage and current, will be explained. Case studies based on data collected from hydrogen and air-cooled generators will be presented.

Topics covered:

- Basic design of HV electrical rotating machines
- Failure mechanisms
- Testing, monitoring, and diagnostics
- When, what and why to test
- What can be monitored

Instructor: Mladen Sasic

Mladen Sasic has thirty years of international experience in design, production, installation, testing and maintenance of Power generation, transmission and distribution equipment. He obtained a Bachelor of Science degree in Electrical Engineering-Electrical Power Engineering from the University of Sarajevo.

Advanced Partial Discharge Interpretation, 8 hrs - $325.00

The course takes the theory of PD one step further to account for Phase Resolved PD (PRPD) patterns found in practice. How to identify the root cause of stator winding PD based on PRPD. The effect of machine operation on PD is also covered, as are the limitations of the PD interpretation.

Topics covered:

- PD interpretation one step further with pulse density linear plots to identify cross-coupled PD activity
- phase to phase activity, and general pulse phase pattern recognition
- behavior of PD activity over time
- defining reliable alerts based on PD activity
- Advanced Summary Numbers (ASN) and their diagnostic value
- PD interpretation on data where two or more different types of failure mechanisms are present

Instructor: Howard Sedding

Dr. Howard Sedding graduated with a BSc in electrical and electronic engineering at the University of Strathclyde and then acquired MSc and PhD degrees. His PhD Thesis was on the degradation of epoxy mica insulation used in rotating machines. He is an active member of numerous technical committees, and has contributed to many IEEE and IEC standards concerned with electrical insulation. Howard has authored and co-authored more than 150 technical papers.