PROTECTION OF HV & EHV TRANSMISSION SYSTEMS

3-Day Professional Development Online Seminar

Date | Time : 23-25 November 2020 | 9am-5pm (AEST)
Venue : (Live Streamed via ZOOM)

By Barrie Moor, B.E (Elec), RPEQ
Introduction

Protection of HV & EHV Electricity Transmission Systems is necessary to maximise safety for the public and electricity industry employees alike, to disconnect faulted plant from the system and to maintain quality of supply to customers. The modern trend is:

+ To operate HV and EHV electricity transmission systems closer and closer to their limits of performance;
+ Augmentation of the power system is often delayed whereby aging plant continues to service customers;
+ Value engineered solutions are often implemented, to achieve the most cost effective provision of electricity supply to network participants.

Under these situations, the associated protection systems are required to meet the crucial requirements of being simultaneously coordinated, fast operating, secure and reliable. These requirements tend to be mutually exclusive, yet meeting them is fundamental to the National Electricity Rules (NER), which mandate the performance of protection systems to maintain power system stability and not restrain power flows within the transmission system network.

What You Will Learn?

This is a 3-day advanced level power system protection seminar focuses on meeting the National Electricity Rules (NER) via the implementation of unit and non-unit protection schemes to HV & EHV transmission systems.

Delegates will learn the principles of protection scheme selection, scheme configuration and the principles associated with the determination of relay settings. The difficulties associated with unique system configurations, such as mutually coupled and/or teed feeders, will also be explored.

Crucial Knowledge for:

◊ **Planning Engineers** to identify the protection implications associated with proposed schemes for augmentation of the power system.
◊ **Maintenance Engineers** to ensure that system protection is not compromised as plant is removed from service during maintenance.
◊ **Circuitry and Automation Design Engineers** to implement protection schemes which optimise power system performance.
◊ **Protection Application Engineers** to identify protection implications and to ensure design and setting principles meet the NER and provide the necessary levels of speed, security, reliability and safety.

Course Content

1 Differential Protection

1.1 High Impedance Differential Protection

• Basic principles
• Principles of relay setting determination
• Voltage and current relay based schemes
• Use of Ratio Correcion CTs (RCCTs)
• Use of voltage limiting non linear shunt elements
  (Metrosils)
• Determination of primary operating current
• Application of Bus Zone Check schemes
• Back-up requirements
• Application of HZ schemes to other plant

1.2 Biased Differential Protection

• Effects of transformer turns ratio
• Effects of transformer phase shifts
• Effects of transformer zero sequence currents
• Determination of CT connections for older style relays
• Determination of relay configurations for microprocessor based relays
• Basic relay setting principles
• Biased differential protection of transformers including earthing transformers
• Biased differential protection of transformers with earthed delta windings

1.3 Application Of Biased Differential Schemes to Busbars

• Schemes types
• CT requirements
• Special features

1.4 Differential Protection of Feeders - Pilot Wire Schemes

• Application of summation transformers
• Application of pilot wire supervision
• Application of overcurrent and earth fault checking
• Application of unstabilising and intertripping

1.5 Differential Protection of Feeders - Current Differential Schemes

• Synchronisation of relays (ping pong)
• Principles of relay setting selection
• CT supervision
• Scheme applications

2 Distance Protection

2.1 Current Transformers

• Steady state performance
• Transient performance \((1 + X/R)\) factor

2.2 Voltage Transformers

• Steady state performance
• Transient performance
• Electromagnetic VTs
• Capacitor VTs
2.3 Distance Relay Fundamentals
- Basic principles of operation
- Amplitude comparators
- Phase angle comparators
- Impedance and Mho characteristics
- Production of complex characteristics (Quad etc.)
- Load encroachment
- Detection of Multi phase faults
- Detection of Earth faults (Ko residual compensation)

2.4 Protection Signalling
- Direct & Series Intertripping
- Distance acceleration
- Permissive intertripping (Underreaching schemes)
- Permissive intertripping (Overreaching schemes)
- Permissive intertripping (Unblocking schemes)
- Blocking schemes
- Directional earth fault schemes
- Use of Power Line Carrier (PLC systems)

2.5 Advanced Aspects of Distance Protection Design
- Mutual Coupling
- Underreaching effects
- Overreaching effects
- Adjacent feeder OOS & Earthed effects
- Distance Relays & Teed Feeders
- Distance Relays & Bridged feeders
- Distance Relays & Fault resistance
- VT supervision
- Polarisation
- Switch On To Fault (SOTF) performance
- Power Swing Blocking (PSB)

2.6 Basic Principles of Reach (Setting) Selection
- Zone 1
- Zone 2
- Back-up Zones
- Reverse Zones

About the Seminar Leader

Barrie Moor, B.E (Elec), RPEQ

Barrie Moor is the Principal Engineer of Power System Protection Training, a provider of professional development training seminars on the topics of power system protection. With over 39 years experience in the Queensland electricity transmission industry, Barrie Moor has been involved in the design, coordination and implementation of protection schemes associated with Queensland’s HV and EHV transmission systems since 1981. Barrie also has extensive experience with the protection of large generating plants.

From 2000 to 2007, Barrie filled the role of Senior Engineer Protection Design, with statewide responsibility, leading Powerlink’s Protection Design Team. From 2007 to 2012, in the role of Principal Consultant Substation Protection, and then Principal Engineer Investigations, Barrie provided specialist Protection Design and Fault Analysis services to support the Asset Management and Operational Groups within Powerlink.

Barrie has 20 years experience within Australia and internationally in the provision of university post graduate training on the design and implementation of HV and EHV Transmission Protection Systems. He has presented a number of papers on specialised aspects of protection design at conferences both within Australia and internationally.

Barrie has also represented Powerlink on CIGRE committee APB5, Power System Protection and Automation and has served as a corresponding member of CIGRE and IEE working groups on Protection Systems.

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<th>Super Early-Bird Fee ( if payment &amp; registrations are received by 16 September 2020 )</th>
<th>Early-Bird Fee ( if payment &amp; registrations are received by 14 October 2020 )</th>
<th>Standard Fee (per delegate )</th>
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