



Your True Partner in Attaining  
Professional Excellence

*A 2-Day Technical Seminar on*

# LIGHTNING PROTECTION of Overhead Lines and Substations

By

**Dr Franco D'Alessandro, B.App.Sc., B.Ed., PhD., SMIEEE**



## What you will learn?

1. Principles of Lightning Protection
2. Lightning Physics and Effects, Personal Safety and Damage Mechanisms
3. How to Carry Out a Lightning Risk Assessment
4. How to Manage the Risk due to Lightning using a simple Checklist Approach
5. How to Protect Overhead Lines
6. How to Protect Substations
7. Fundamentals fo Earthing for Lightning Transients

## Course Overview

Lightning is a common and significant cause of outages on most power systems. Mitigation of the effects of lightning is often not well understood and can often be improved. This course is designed to provide a background in lightning protection for those people responsible for the reliability of power distribution and transmission systems as well as substations. The seminar will include constant references to international best practice, as articulated in the relevant Standards, e.g., IEEE 1243, IEEE 1410, IEEE 998, AS 2067 and AS/NZ 1768.

## Who should attend?

This 2-day course will present a practical approach to lightning protection and is intended for managers and engineers concerned with the design of new lines and substations and with implementing appropriate measures to improve the lightning performance of existing lines and substations. It will be of considerable value to engineers and technicians involved in the operation of power systems during thunderstorms. The course will also be of interest to non-specialist engineers and graduate students who would benefit from an introduction to lightning and lightning protection. No prior knowledge is assumed.

Course participants may be required to work illustrative examples during the course and therefore should bring a calculator to the seminar.

## About the Course Leader

**Dr Franco D'Alessandro**, *B.App.Sc., B.Ed., Ph.D., SMIEEE*



**Franco D'Alessandro** received the degrees of B.App.Sc. (majoring in mathematics and physics), B.Ed. (secondary teaching) and Ph.D. (experimental physics) from the University of Tasmania, Australia, in 1986, 1987 and 1996 respectively.

The first decade of his career was in university teaching & research. He then moved into the private sector where he worked for more than a decade in lightning protection as a senior research scientist and R&D product engineer, both in Australia and the United States. In December 2007, he became Managing Director & Principal Consultant for PhysElec Solutions Pty Ltd, an Australian consultancy services company that delivers global solutions in electrical engineering and applied physics, with specialisation in lightning, surge & transient protection, earthing & grounding, high voltage engineering and power electronics.

Dr D'Alessandro has delivered many seminars and presentations on lightning protection within Australia and overseas and has published more than 65 technical papers on lightning protection. He is a Senior Member of the IEEE and a participating technical member of Standards and code-setting committees on lightning protection in Australia, Europe and the United States.

### CPD Recognition

This training program is especially designed to meet the Continuing Professional Development (CPD) needs of participants. A Certificate of Attendance will be awarded at the end of the program. This serves as evidence of your personal and professional commitment to your career.

# COURSE OUTLINE

1. **INTRODUCTION**
2. **GENERAL PRINCIPLES of LIGHTNING PROTECTION**
3. **LIGHTNING ATTACHMENT**
  - 3.1 Lightning Physics
  - 3.2 Lightning Phenomenology
  - 3.3 Damage Mechanisms and Causes
  - 3.4 Lightning Detection and Location
  - 3.5 Lightning and Human Safety
4. **COMPREHENSIVE APPROACH for PROTECTION AGAINST LIGHTNING**
  - 4.1 Protection Checklist
  - 4.2 Air Terminations
  - 4.3 Down conductors
  - 4.4 Earthing Systems
  - 4.5 Surge Protection Devices
5. **RISK ASSESSMENT and RISK MANAGEMENT**
  - 5.1 Ground Flash Density
  - 5.2 Calculation of Lightning Exposure Area
  - 5.3 Risk Assessment Methodology
  - 5.4 Relationship to Lightning Statistical Distributions
  - 5.5 Introduction to Poisson Analysis
6. **LIGHTNING OVERVOLTAGES**
  - 6.1 Induced Overvoltages
  - 6.2 Direct Strike Overvoltages
  - 6.3 Back-flashovers
  - 6.4 Propagation of Lightning Surges on Line Conductors
  - 6.5 Calculation of Transmission Line Transients
7. **LIGHTNING PROTECTION of OVERHEAD LINES**
  - 7.1 The Electrogeometric Model
  - 7.2 Direct Strikes to Unshielded Lines
  - 7.3 Direct Strikes to Shielded Lines
  - 7.4 Indirect Strikes
  - 7.5 Use of Surge Arresters
  - 7.6 Calculation Tools (IEEE FLASH etc.)
  - 7.7 Active / Preventative Lightning Protection
  - 7.8 New AEMO Procedures in Australia
8. **LIGHTNING PROTECTION of SUBSTATIONS**
  - 8.1 Equipment BIL and Protection Level
  - 8.2 Empirical Design Methods
  - 8.3 Electrogeometric Models
  - 8.4 Effective Shielding Against Nearby Direct Strikes
9. **LIGHTNING IMPULSE CHARACTERISTICS of INSULATION**
  - 9.1 Insulation Principles
  - 9.2 BIL, CFO and Standard Lightning Voltages
  - 9.3 Non-Standard Lightning Voltages
  - 9.4 Location of Arresters
  - 9.5 Arc Quenching Properties
10. **EARTHING for PROTECTION AGAINST LIGHTNING**
  - 10.1 Basic Principles – Earthing Systems, EPR, Step & Touch Potential etc.
  - 10.2 Resistance vs Impedance – Factors & Dependencies
  - 10.3 The “Critical Length” when Designing for Lightning
  - 10.4 Practical Tips
11. **SUMMARY**

## Customised In-House Course Available

This program can be customised to suit specific needs of your organisation at significant savings.

Please contact us on (02) 8448 2078 or email [enquiry@cpdint.com.au](mailto:enquiry@cpdint.com.au) for more details.