

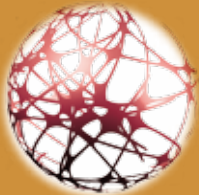


**GCC Electrical
Testing Laboratory**
المفتبر الفليبي لفمص الممدات الكهريانية

Electromagnetic Transients and procedure for Insulation Co-ordination

Background Electromagnetic transients that affect all transmission systems are originated by internal events, i.e. faults and switching operations, and by external events, i.e. lightning strokes hitting overhead lines.

EMTs are of interest mainly for the insulation co-ordination of the transmission system in the basic design of the network and in the specification of the basic characteristics of equipment and machinery (transformers), but they can even affect the system planning, mainly when unacceptable temporary overvoltages are expected and they have to be avoided by provisions that can even impinge on the development of the network.



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Education
Course Code: **E14**



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Electromagnetic Transients and procedure for Insulation Co-ordination

MARCH
4 - 8
2018



GCC Electrical Testing Laboratory

المختبر الفليبي لفحص المعدات الكهربائية

Objectives

The course provides an exhaustive description of the electromagnetic transients (EMT) in transmission systems and an outline of the insulation co-ordination of substation and lines.

Furthermore, the course a comprehensive knowledge of the behavior of the system in all its performance aspects (load-flow, short circuit, electromechanical transients, harmonics, control) which is the basis for understanding any EMT phenomenon.

Addressed to:

Engineers Specializing in Insulation Coordination Activities

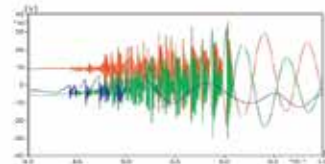
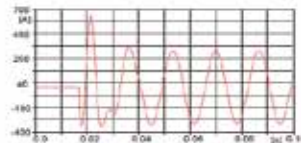
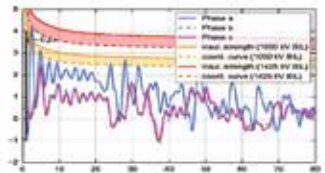
Duration:

5 Full Days

Location/Venue:

GCCIA HQ, Dammam

Course Fees:



PROGRAM

The Course program contains the following training outline:

DAY 1	<p>EMTs generals - EMTs originated by lightning</p> <ol style="list-style-type: none"> Introduction to Electromagnetic transients in transmission systems Physic and mathematical aspects related to the analysis of electromagnetic transients Lightning phenomenon: statistics of occurrence and of stroke current parameters Electromagnetic transients originated by lightning strokes <ol style="list-style-type: none"> Back-flashover of overhead lines Shielding failure of overhead lines 		
DAY 2	<p>EMTs originated by internal events</p> <table border="0"> <tr> <td style="vertical-align: top;"> <ol style="list-style-type: none"> Fault application Fault clearing Line energization Single-pole-reclosing Three-phase reclosing Load rejection Load rejection following fault clearing Transformer energization Switching (opening) of magnetizing currents </td> <td style="vertical-align: top;"> <ol style="list-style-type: none"> Operation of disconnecting switch in open air station Restrike of circuit breaker in opening of no load line Restrike of circuit breaker in opening of shunt capacitor banks Operation of disconnecting switch in open air station Very fast front overvoltages inside GIS (SF6) station <ul style="list-style-type: none"> - Operation of disconnecting switch - Internal fault. </td> </tr> </table>	<ol style="list-style-type: none"> Fault application Fault clearing Line energization Single-pole-reclosing Three-phase reclosing Load rejection Load rejection following fault clearing Transformer energization Switching (opening) of magnetizing currents 	<ol style="list-style-type: none"> Operation of disconnecting switch in open air station Restrike of circuit breaker in opening of no load line Restrike of circuit breaker in opening of shunt capacitor banks Operation of disconnecting switch in open air station Very fast front overvoltages inside GIS (SF6) station <ul style="list-style-type: none"> - Operation of disconnecting switch - Internal fault.
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DAY 3	<p>EMT Simulation Tools and Modeling of Electrical Components</p> <ol style="list-style-type: none"> Electromagnetic transients' simulation tools: ATP, ATPDRAW Modelling of electrical components for EMT simulation <ul style="list-style-type: none"> - Passive elements - Network equivalents - Synchronous machines and their AVR - Overhead lines and cables - Transformers with saturation and hysteresis - Surge arresters - Circuit breakers 		
DAY 4	<p>Simulation of EMTs</p> <ol style="list-style-type: none"> Simulation of electromagnetic transients originated by lightning strokes <ul style="list-style-type: none"> o Lightning performance of station Simulation of electromagnetic transients originated by internal events: <ul style="list-style-type: none"> - Switching (slow front) overvoltages - Temporary overvoltages - Very fast front overvoltages 		
DAY 5	<p>Outline of Insulation Co-ordination procedure and examples of application</p> <ol style="list-style-type: none"> Insulation co-ordination performance criteria Reference Standards and documentation Procedure for: <ul style="list-style-type: none"> - selection of insulation withstand of substation and line equipment - selection and location of protective devices (surge arresters) Examples of application 		