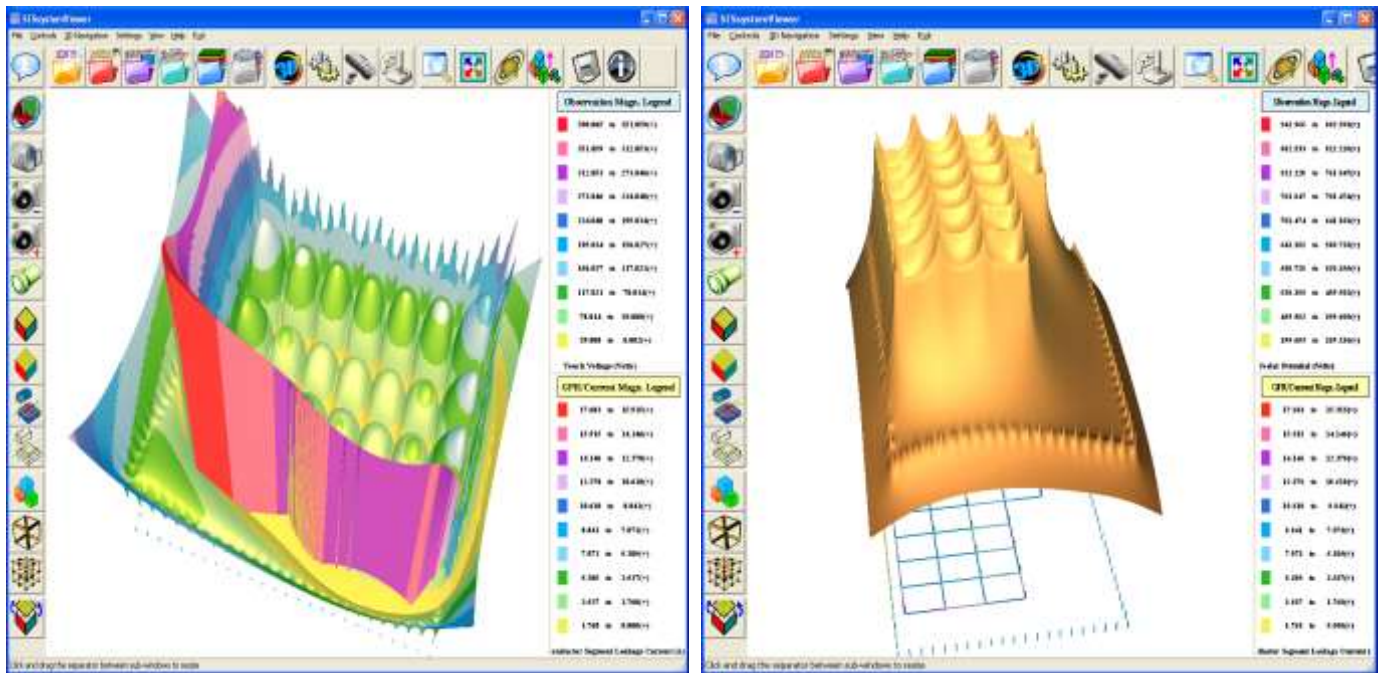




Safe Engineering Services & technologies Ltd.

**Advanced Technical Seminar on  
Power System Grounding & Electromagnetic Interference Analysis  
and CDEGS Level I Certification**



Location	Date	Course Fee
Montréal, Canada	May 15 to 19, 2017	USD 2,565.00
	September 25 to 29, 2017	

**Course Objective**

This 5-day course provides attendees a unique opportunity to acquire practical and up-to-date engineering knowledge, from the world's leading specialists and researchers, on how to study and design efficient and economical grounding and lightning mitigation systems. Whether you wish to protect a power system, plant or a nearby utility subjected to electromagnetic interference from power system faults, lightning or switching surges, this course will present pertinent principles for utility, industrial and various public installations, during steady state, fault and transient conditions, using realistic models of the environment.

The emphasis will be put on demonstrating scientific concepts using practical examples drawn from the extensive number of research projects and engineering studies conducted by SES researchers since 1978. Pertinent analytical derivations are included in the extensive Reference Manual made available to all course participants. One of the main goals of this course is to explain and eliminate many misconceptions, ambiguities and incorrect measurement, analysis and design techniques which still abound in the industry and are taught at some courses.



## Course Outline

During **Part I** of the course, the three modes of electromagnetic energization will be explained. Earth resistivity measurement and interpretation techniques will also be discussed, for uniform and multilayered earth (soils with two and more horizontal and vertical layers). The concept of soil model equivalence and soil layer resolution will be explained based on computer simulations. The analysis and design of simple and complex grounding systems made of arbitrarily oriented three dimensional conductors buried in multilayered soils will be discussed and illustrated with practical examples. The case of a grounding system partially buried in a finite volume (e.g., backfill) of heterogeneous soil will be explored. The scientific concept of earth impedance measurements using the Fall of Potential method will be clearly explained based on various realistic soil models. Transmission line, buried cable and buried pipeline parameters (self and mutual impedances) in layered earth will be analyzed and fault current distribution computation techniques will be described. Electric safety concepts will be introduced and issues involving body currents, body impedances and foot resistances will be discussed for power frequency and high frequency electric exposure.

**Part II** is entirely devoted to a workshop aimed at learning how to use SES powerful input and output processors such as SESCAD, ROWCAD and SESShield3D.

In **Part III** of the course, conductive and inductive interference effects caused by energized conductors on overhead and buried bare or coated metallic structures and conductors, such as pipelines, fences and communication wires are introduced and investigated in detail. Mitigation methods and equipment are presented and their relative merits are discussed. Interaction between the sources of the interference and the victim lines or circuits will be examined in detail. Finally, electric and magnetic fields generated by energized overhead and buried conductors at low and high frequencies as well as during transient conditions, such as lightning strikes, will be described and typical analysis methods and computation results explained.

## COURSE OUTLINE

### PART I - Fundamental Concepts and Power Frequency Analysis

#### Monday

#### Registration and Introduction

8:00 a.m. - 8:30 a.m.

#### Session 1

8:30 am - 12:00 am

#### Fundamental Concepts, Soil Resistivity and SES Software Packages Structure

- Electric energization modes
- Soil structure models and characteristics
- Impedance Concepts
- Soil resistivity measurement and interpretation
- "How far is far enough"
- Noise analysis & suppression
- Preview of SES software packages
- **Computer Workshop**

#### Session 2

1:00 pm - 5:00 pm

#### Grounding System Analysis & Design

- Theory of grounding system analysis
- Return electrodes and buried structures
- Horizontal, vertical, hemispherical, cylindrical soil layering and finite volume soils
- Design optimization to reduce GPR, touch and step voltages
- Introduction to electrically large grounding systems
- **Computer Workshop**



Tuesday		
<b>Session 3</b>	<b>Session 4</b>	
<b>8:00 am - 12:00 am</b>	<b>1:00 pm - 5:00 pm</b>	
<b>Earth Impedance Concepts and Measurement &amp; Interpretation</b>	<b>Fault Current Distribution in Power System Networks and Line Parameters</b>	
<b>Electrical Safety Concepts and Criteria</b>		
<ul style="list-style-type: none"> <li>• Fall-of-Potential measurement technique</li> <li>• Earth impedance measurement and interpretation</li> <li>• Noise analysis &amp; suppression</li> <li>• Electrical shock mechanisms</li> <li>• Body current thresholds, IEEE Std. 80; IEC 479; effects of frequency; heart current factors</li> <li>• Body impedance, Foot resistance and Thevenin concepts</li> <li>• <span style="color: red;">Computer Workshop</span></li> </ul>	<ul style="list-style-type: none"> <li>• Fault current computation - simplified methods</li> <li>• Multiple terminal systems; modeling of shield wires, neutrals and counterpoises</li> <li>• Steady-state conditions, harmonics and unbalances</li> <li>• Fault current computation - detailed methods</li> <li>• Computation of self and mutual impedances and capacitances of overhead and buried conductors; uniform and layered soils</li> <li>• Modeling of transformers</li> <li>• <span style="color: red;">Computer Workshop</span></li> </ul>	
<b>PART II - SES Graphical Input and Output Processors Workshop</b>		
Wednesday		
<b>Session 5</b>	<b>Session 6</b>	
<b>8:00 am - 12:00 am</b>	<b>1:00 pm - 5:00 pm</b>	
<b>SES Integrated Graphical Input Environment SESCAD</b>	<b>Other Graphical Software Packages and Tools</b>	
<ul style="list-style-type: none"> <li>• Using SESCAD Basic Features and Tools</li> <li>• Advanced Features: Insert, Define, Display, Tools, Advanced</li> <li>• Creating a Right-of-way</li> <li>• Transformers, Cables, GIS and GIL</li> <li>• Import and Export Functions</li> </ul>	<ul style="list-style-type: none"> <li>• Running and Exploring Results from SESCAD</li> <li>• SESSystemViewer, GRSERVER</li> <li>• ROWCAD, GRSPLITS3D</li> <li>• SESHIELD3D, SES-Impedance</li> <li>• Other SES Tools</li> </ul>	
<b>Wednesday Evening</b>	<b>6:00 - 8:30 PM</b>  <b>9:00 - 11:00 PM</b>	<b>Walleyball game (SES versus attendees)</b>  <b>Complimentary dinner hosted by SES</b>



## PART III – EMI, High Frequency and Transient Analysis

### Thursday

<p><b>Session 7</b> 8:00 am - 12:00 am</p>	<p><b>Session 8</b> 1:00 pm - 5:00 pm</p>
<p><b>Electromagnetic Interference, Environmental and Mitigation Techniques</b></p>	<p><b>Effects of Frequency on Grounding Systems, large grounding systems</b></p>
<ul style="list-style-type: none"> <li>• Inductive, Capacitive and Conductive interference mechanism</li> <li>• Modeling of pipelines and buried metallic structures</li> <li>• Grounding design of valve and test stations</li> <li>• Combined influence of inductive and conductive coupling and mitigation</li> <li>• Effects of coating characteristics</li> <li>• Environmental impact assessment</li> <li>• Mitigation techniques and cathodic protection issues</li> <li>• <b>Computer Workshop</b></li> </ul>	<ul style="list-style-type: none"> <li>• Description of the field approach</li> <li>• Frequency dependence of conductors</li> <li>• Performance at high frequency</li> <li>• Extensive grounding systems</li> <li>• Effect of conductor characteristics on performance of grounding system</li> <li>• Effects of circulating current from local generators in grounding study of a large power plant</li> <li>• Modeling Cables, GIS and GIL Systems</li> <li>• Induction to communication and protection circuits</li> <li>• Stress voltage reduction</li> <li>• <b>Computer Workshop</b></li> </ul>

### Friday

<p><b>Session 9</b> 8:00 am - 12:00 am</p>	<p><b>Session 10</b> 1:00 pm - 2:00 pm</p>
<p><b>Electrical and Magnetic Fields, Transients and Lightning Shielding - I</b></p>	<p><b>Electrical and Magnetic Fields, Transients and Lightning Shielding - II</b></p>
<ul style="list-style-type: none"> <li>• Lightning shielding analysis</li> <li>• Capacitor switching in substations</li> <li>• Computation of electric and magnetic fields</li> <li>• Lightning transient studies</li> <li>• <b>Computer Workshop</b></li> </ul>	<ul style="list-style-type: none"> <li>• Additional topics selected by attendees</li> <li>• Submission of CDEGS Level I Certification exam documents</li> <li>• <b>Distribution of Certificates</b></li> </ul>

**End of Sessions**



### Course Instructors

The principal course lecturer will be **Dr. Farid P. Dawalibi**, an internationally recognized expert and authority in grounding and electromagnetic interference. In addition to his pioneering research work, Dr. Dawalibi was the project leader of the team which developed the GATL and ECCAPP software packages (EPRI EL2699 and EL5472) and the AUTOGRID<sup>®</sup> software package (CEA 249 D 541). He is presently the Director of Engineering and R&D and is responsible of the research department in charge of developing and maintaining CDEGS<sup>®</sup>, the most advanced and powerful grounding and electromagnetic interference software package. Dr. Dawalibi has published over 450 technical papers, research and engineering reports and has presented more than 150 technical seminars and short courses. He has written part of ANSI/IEEE Standard 80 and he has also served as an expert witness at several challenging court hearings and is a technical advisor and industry consultant to several leading power, pipeline and railway utilities.

### Course Fee

The course fee<sup>1</sup> includes an extensive Reference Manual entitled "Power System Interaction with Earth and Industrial Utility Installations," annotated copies of course display materials, and several copies of pertinent technical papers published by SES. The fee also includes a full course lunch, coffee tea and refreshments during the morning and afternoon sessions. Participants must bring their own laptops for the workshop portion of the seminar. However, for an additional **US\$ 215<sup>1</sup>**, a laptop computer can be provided for the duration of the seminar. More information will be provided to prospective participants when they enroll.

<sup>1</sup> Applicable sales tax not included.

### Education Credit

Participants will be issued a certificate of completion and awarded the equivalent of 3.5 CEU or 35 PDH (35 hours of classroom instructions). The CEU or PDH is a recognized unit for recording participation in noncredit educational programs.

Those who wish to participate in the **Level I certification** and pass the Level I certification tests will receive by mail SES Level I certification that will make them eligible for future **Level II and Level III certifications**.

### Cancellation Policy

SES reserves the right to cancel or change the dates or location of any of the seminars. In this case, participants will be notified immediately and any fee received will be refunded in full. Cancellation of course registration is accepted up to four weeks before the seminar, with a handling charge of 10% of the seminar fee retained. Cancellation after this date is subject to 50% of the seminar fee. No cancellation will be accepted two weeks before the start of the seminar.

### How to Enroll

<b>Call:</b>	<b>North America toll free: 1 800-668-3737; Other locations: 1 450 622-5000</b>
<b>Email:</b>	<b><a href="mailto:info@sestech.com">info@sestech.com</a></b>
<b>Enroll Online:</b>	<b><a href="http://www.sestech.com/Training/TrainingRegistration.aspx">http://www.sestech.com/Training/TrainingRegistration.aspx</a></b>



## Upcoming Seminar Locations and Information

Bring yourself to the forefront of power system grounding and electromagnetic interference technology with a 5-day course presenting not only basic theory and practical considerations associated with power system grounding, AC interference mitigation and EMI/EMF analysis, but also giving you ample opportunity to work with state of the art software tools as part of hands-on sessions. These sessions are designed to familiarize you with modern computer modeling techniques and give you an intuitive feel for how grounding systems behave, based on the vivid graphics that these modeling techniques can provide. At the same time, you will meet leading researchers in the field, who can help you distinguish between age-old myths and reality and gives you new perspective on your present work. Furthermore, the courses provided by SES give you an opportunity to network with other attendees doing similar work.

Location	Room Rate	Date
<b>Le Centre Sheraton Montréal</b> <a href="http://www.sheratoncentremontreal.com">www.sheratoncentremontreal.com</a>  1201, boulevard René-Lévesque W., Montréal (Québec) Canada H3B 2L7  Telephone : 1-514-878-2000	Preferential rate of CAD 189.00 (single or double occupancy)  On-line booking link will be provided when you enroll for the seminar <a href="#">online</a> .	May 15 to 19, 2017
		September 25 to 29, 2017

Please mention "SES Seminar" when booking by phone.

