Applications of PSCAD™ and Transient Studies
Duration: 3 Days

Course Description
This course covers the fundamentals of the study of electromagnetic transients in electrical networks. A number of application areas such as AC transients, fault and protection, transformer saturation, wind power, FACTS, power quality, as well as other power systems topics will be discussed with practical examples serving to illustrate the subjects. Several case studies will be applied in detail to highlight practical situations encountered by engineers in the field.

Course participants will be able to experiment with the case studies in an interactive hands-on workshop environment using the PSCAD Simulation software. Attendees can request coverage of specific topics or phenomena of interest.

Previous experience with the PSCAD software tool is not required.

Who should attend?
This course is intended for practicing engineers, graduate students, and researchers in power systems and power electronics, who are interested in developing an in depth understanding of the modern tools available for the analysis of transient events in the network. The course is intended for existing PSCAD users as well as introductory users.

Course Topics
1. Installing the software and getting started
   3. Fundamental theory of transient simulation
      • Representation of power system components and control system elements
      • Selection of the simulation time step
      • Studies that require simulation tools such as PSCAD
      • Advanced features of PSCAD for fast and accurate solutions

2. Creating a small simulation case using PSCAD
   • Building the power system model
   • Data entry
   • Results, graphs, plots, and meters
   • Interactive control features of PSCAD (sliders, push buttons, dials and switches)

4. A review of the various models and examples available in PSCAD

5. Development of an AC system model suitable for:
   • Temporary over voltage studies
   • Switching over voltage studies
   • Network resonance
   • Representation of power system elements such as lines and cables, transformers, and shunt devices
   • Representation of surge arresters
   • Network equivalences
   • Model validation
   • Discussion of prior outage and contingency conditions
   • ‘Multiple run’ feature of PSCAD parametric studies

6. AC system transient studies
   • Switching over voltage studies (SOV)
      – Line energizing and cable energizing transients
      – Resonance due to transformer energizing
      – Breaker re-strike
      – Energy dissipation of surge arrestors, arrester rating and the selection of arrestors
• Transient recovery voltage across breakers (TRV)
  − Developing the system and the substation model suitable for TRV investigations
  − Station faults, short line faults and remote faults
    • Batch mode processing to capture the ‘worst case’
    • Determination of station stray capacitance values and representation in the study
    • IEEE breaker capability curves
  • Capacitor bank back to back switching, selection of inrush and out-rush reactors
  • Lightning over voltages studies

7. Transformers
• Saturation and inrush current issues
• Representing different core types
• Unbalanced loading and grounding
• Example and demonstration: Ferro resonance

8. Faults
• Preparing the simulation to perform a sequence of events such as the occurrence of a fault, breaker opening, fault clearance and re-closure etc.
• DC offset in fault current, the rate of decay, and its influence on CT saturation and relay mal-operation
• Automated generation of a large number of fault waveforms in COMTRADE format for real time relay testing

9. Protection systems
• Detailed CT saturation models
• Modeling a simple relay scheme
• Discussion of selected case studies

10. Machines
• Synchronous machines
  − Controls, including governors, exciters, PSS, ect.
  − Sub synchronous resonance issues and modeling
• Large induction motors starting issues; including flicker and voltage dip problems
• Drive example

11. Simulating wind generation
• Large induction motors starting issues; including flicker and voltage dip problems
• DFIG example - SSR concerns

12. Power Electronic Basics, HVDC and FACTS
• Using power electronic modules and designing simple firing systems
• PSCAD interpolation method
• Introduction to HVDC theory (line commutated) and simulation examples
• SVC
• STATCOM

13. Power Quality
• Arc furnace loads
• Evaluation of flicker severity

Instructor
Course instruction will be provided by one of our many simulation and application experts from the team of PSCAD Support Engineers.

Course Particulars
For courses at a clients location:
• A workbook with tutorial examples, and PSCAD software and a temporary license(s) for use during the course will be provided.
• All instructor travel and accommodation expenses are included in the training quotation.
• The client is required to arrange for use of a training room, computers for the students, a VCD (LCD) projector, and a large whiteboard.

For courses at our office in Winnipeg:
• A workbook with tutorial examples will be provided.
• A computer equiped with PSCAD software and license will be supplied for use during the course.
• Lunches are provided on site during training days.
• Hotel accommodations and local travel are the responsibility of the student. Contact us for a list of local accommodations.
• A minimum enrolment is required. Students will be notified two weeks prior to commencement if the course is cancelled.

Please contact us if you have any questions, would like a quotation, or if you would like register for any of our courses. Email: training@pscad.com

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