TRAINING

Power System Stability and Control

12-14 December 2006 – Jakarta

Summary:

This course is focused on the study of large-scale power systems, with particular reference to studying the network behavior under steady-state and disturbance conditions. The objective is to enable course participants gain a better understanding of the inter-play that exists between the various electro-mechanical network quantities, and the factors that can affect the performance of networks. Conventional as well as modern techniques which can be used to enhance the stability performance of the networks are described.

The course begins with a review of the theory of synchronous machines, transmission lines, transformers and other major components of power systems. The treatment is from the system-theoretic point of view. A study into the analytical models of the power system components necessary to represent them in computer simulation studies is included.

Fundamentals on network real power-frequency, reactive power-voltage control systems are covered. Small-signal analysis of networks, essential for gaining an understanding of the dynamics involved in power systems, is demonstrated through the application of frequency-response methods. Network frequency regulation is studied through examining the actions of the speed-governor generator-turbine-network control loop. The effects of generator excitation systems on system performance and tuning methods applicable to the excitation systems are studied during the course.

Large-disturbance stability analysis of networks is also considered. The approach is to use modern digital time-domain simulation technique. Apart from the conventional stabilization methods, other modern techniques for stability enhancement, including that of power-electronics based shunt (SVC, STATCOM) and series compensation devices (TCSC), and combined series-shunt compensators (UPFC), are included as part of the simulation network systems.

Where applicable, numerical examples are used to reinforce the course materials covered. In addition, course participants will have the opportunity to participate in computer simulation studies. The simulation cases are based on realistic network examples so that all course participants will gain a better understanding of the subject matter at the conclusion of the simulation study exercise.

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Course Contents

Duration: 16 hours

Network Components (4 hrs)
Synchronous machine
Elementary models, development of the general machine equations, general power equations, Blondel Transformation, steady-state machine model, equivalent circuit representation. Machine under sudden 3-phase short-circuit.

Power transformer
Equivalent circuits, 3-winding transformer.
Transmission Line
Equivalent circuits.
Power System Loads

Steady-state Power System Networks (3 hrs)
Admittance matrix formulation, Power Flow
Voltage and Reactive Power Control

System transient stability models (5 hrs)
Generator Transient System Models, Speed-control, Excitation System. Controller tuning methods.
Power electronics-based controllers. SVC, STATCOM, TCSC, Static Phase Shifter, UPFC.

Case Studies (4 hrs)
Computer simulation studies are based on realistic network examples.
Simulation cases include: excitation system tuning, load switching, and stability under fault conditions. The beneficial effects of conventional and modern power-electronics based controllers will be demonstrated.

Course instructor:

Dr SS Choi
Professor, Division of Power Engineering
Nanyang Technological University, Singapore.

Fee:

Course Fee : **US$. 990-00** per person
Fee does not include lodging, transportation and taxes.

Registration:

PT. CAHAYA SUKSES
PO BOX. 1252 Jakarta 12012 Indonesia
Contact : Moh. Hudri / Narti
E-mail : cahayas@cbn.net.id or csukses@centrin.net.id
Tel. (021) 7889 3712 / 3 Fax. (021) 560 1496

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Curriculum Vitae

S. S. Choi (CEng, MIET, CPEng MIE Aust, MIEEE) received his B.E. and Ph.D. degrees from the University of Canterbury, New Zealand, in 1973 and 1976, respectively.

He then worked in the New Zealand Electricity Department before he took up a lecturing post at the National University of Singapore in 1978. He joined the State Energy Commission of Western Australia (SECWA) in 1981 where he was responsible for system studies pertaining to stabilities, voltage control, power quality, SVC applications, and network transients. From 1989 to 1992, he was Head of the System Analysis Section, Transmission Development Department, SECWA.

He left SECWA in October 1992 to join the School of Electrical and Electronic Engineering, Nanyang Technological University, where he is now a Professor. He was also Head of the Power Engineering Division from April 1995-July 2005. His research interests are power system dynamics, FACTS, and power quality.

While he was with SECWA, major projects which he initiated or where he was a principle investigator include:

- Ord Hydroelectric Scheme: transmission system feasibility studies involving a 2x20 MW generating station, three single circuits 120 km 132kV transmission;

- Dampier-Karratha-Port Hedland Interconnection: transmission system study including load flows, fault calculations, stability for a new Karratha 2x20 MW gas-turbine station, 180 km 220kV Port-Hedland-Cape Lambert transmission system. System field test and verification of study results. Project cost: A$27 million (Approx);

- Eastern Goldfields Project: power transfer from a main coal-fired power station through a 640km 230kV transmission system, up to 150 MW transfer, three saturated-reactor type static VAr compensators (SVC). In addition to the usual system studies, harmonics, network imbalance, sub-harmonic, insulation coordination and transient stability had been examined. Project cost: A$100 million (approx);

- Mungarra and Pinjar Gas-turbine Generation Expansion: excitation control and power system stabilizer control settings for over 10 units of the frame 6 gas-turbines, validation of the study results with field test data;

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- North Country Region Voltage Stability Investigation: to overcome the observed voltage instability due to the inappropriate settings of the under-excitation limiters on some gas-turbine units. Proposed changes to the limiter design allow the output of the gas-turbine to be increased significantly.

Since joining NTU, Dr Choi has been involved in several research areas and these are :

- Custom Power/Quality of Supply: using power electronic switching devices to improve voltage quality through series compensation. One such equipment is the dynamic voltage restorer;

- Flexible AC Transmission Systems: again using power electronics devices, the resulting flexibility in network control allows improved network stability and dynamic performance. Use of energy storage system in Unified Power Flow Controller for increased power transfer capability;

- Solid-oxide Fuel cell: investigation into the use of the fuel cell for stationary power generation purposes. The SOFC forms part of a distributed generation system.

Dr Choi also provides external short courses in power system stability and dynamics, power quality and condition monitoring to utility industry, oil and gas companies and engineering companies. These clients include the Sarawak Electricity Corp, PLN of Indonesia, Caltex Indonesia, Singapore Power and Power Grid Ltd. He also offers professional services in the area of system studies, including that to Unocal (Indonesia) and SP Powergrid (Singapore).

Dr. Choi received the IEE S.Z. De Ferranti Premium Award for the 1989/1990 Session and was one of the recipients of the IEEE Power Engineering Society Surge Protection Devices Technical Committee High Interest Paper Award 2004. He is a member of the IEE and the Institution of Engineers, Australia. He is a Chartered Professional Engineer of Australia.

He is a member of the Editorial Board of the Proc. of IEE Generation, Transmission and Distribution (UK), an Editorial Adviser of the Journal of Automation of Electric Power Systems (China)

Registration Form

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Please complete a registration with payment to **PT. Cahaya Sukses** to confirm registration. Reservations are taken on a first come, first serve basis. Submitting this form electronically does NOT confirm your reservation. Contact cahayas@cbn.net.id or csukses@centrin.net.id if you have any questions.

Name _____

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Remark:
1. A confirmation letter will be sent to you upon receipt of the enrollment form.
2. Any cancellation must be in writing and received by 14 days prior to the course date. Otherwise the full fee will be chargeable. **PT. Cahaya Sukses** reserves the right to reschedule, change venue or cancel the course due to unforeseen circumstances.
3. Course fee does not include lodging, transportation and taxes.

Note : For group registration, please photocopy this form for submission