The operation of today’s increasingly complex power systems requires comprehensive training of system dispatchers and operations engineers. By increasing awareness and understanding of dynamic phenomena, the EPRI Power System Dynamics Tutorial (1001983) can improve an operator’s ability to take effective preventive and corrective actions. Intended to complement the EPRI Operator Training Simulator and EPRI’s NERC-approved courses for operator continuing education, the tutorial is an easy-to-understand supplement to utility-specific training materials.

Revising a Classic to Meet Today’s Challenges
EPRI developed the first system dynamics tutorial in 1989 to enhance the training of power system dispatchers. EPRI released a second edition in 1998. These earlier versions were well received, with thousands of copies in use by power system operators throughout North America.

A number of important industry-wide changes led to a third revision. First, the formation of regional transmission organizations has dramatically increased the geographical area over which an operator has responsibility, with blackouts in one power system potentially affecting a huge portion of North America at one time. Cost-effective training has thus become more and more critical to system reliability. In addition, current North American Electric Reliability Corporation (NERC) requirements that operators be certified via standard examinations, coupled with new operating procedures and guidelines, also factored into EPRI’s decision to revise the tutorial. Finally, and most importantly, comprehensive information was needed to help operators understand how to cost-effectively restore a system following a blackout. EPRI will continue to update the tutorial to reflect the NERC-issued operating procedures and reliability standards.

Material and Organization
The current edition includes an introductory review of power system fundamentals, followed by chapters on active and reactive power flow, frequency and voltage control, voltage and angle stability, and power system oscillations. It also includes chapters on harmonics, resonance, subsynchronous resonance, ferroresonance, and solar magnetic disturbances. An entire chapter is devoted to the construction and operation of high-voltage direct-current systems and phase shifting transformers.

The book explains the causes of power system shutdowns with an emphasis on the theory of power system restoration and the methods used in such restoration. Topics of great interest in this area include voltage and frequency control, equipment and protective relay issues, and synchronizing issues that may be encountered during power system restoration. Also discussed are possible strategies to employ during system restoration along with lessons learned from actual restoration events occurring in North American power systems.

The tutorial uses a direct style, relying on physical analogies, intuitive reasoning, and actual case histories rather than on complex engineering terminology and numerous mathematical equations.
Companion Web Site
To supplement the tutorial, EPRI has developed a companion web site ([www.epriots.com](http://www.epriots.com)) that features training exercises on generic power systems using the EPRI Operator Training Simulator. Such training—together with application of the tutorial—helps promote operator proficiency while supporting reliable and economic power system operation.

Training
Grid operators and operator trainers will use the updated tutorial with the EPRI Operator Training Simulator to enhance the training of power system operators. Users group and training workshop meetings will be held to bring operator instructors together on the use of the EPRI operator training materials and to exchange experiences and information about best practices for operator training.

As part of its commitment to operator training, EPRI offers a catalog of courses for operator continuing education credits. EPRI is recognized by NERC as a continuing education provider that adheres to NERC Continuing Education Program Criteria.

Audience
The tutorial is intended for use by power system operators. EPRI's goal with this tutorial is to ensure that operators acquire the necessary knowledge to exercise critical judgment in emergency situations falling outside the scope of step-by-step utility procedures.

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Contact Information
For more information, contact the EPRI Customer Assistance Center at 800.313.3774 ([askepri@epri.com](mailto:askepri@epri.com)).