

2000 Power Engineering Society Summer Meeting
Volume 1

2000 POWER ENGINEERING SOCIETY SUMMER MEETING

CONFERENCE PROCEEDINGS

VOLUME 1

**16 – 20 JULY 2000
SEATTLE, WASHINGTON USA**

SPONSORED BY

POWER ENGINEERING SOCIETY

AND

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

2000 IEEE Power Engineering Society Summer Meeting

Abstracting is permitted with credit to the source. Libraries are permitted to photocopy, beyond the limits of U.S. Copyright law for private use of patrons, those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. For other copying, reprint, or republication permission, write to the IEEE Copyright Manager, IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. All rights reserved. Copyright © 2000 by the Institute of Electrical and Electronics Engineers, Inc.

IEEE Catalog Number: 00CH37134 (softbound)
IEEE Catalog Number: 00CB37134 (casebound)
IEEE Catalog Number: 00CH37134C (CD-ROM)

Library of Congress Number: 00-02857

ISBN	Softbound: 0-7803-6420-1
	Casebound: 0-7803-6421-X
	Microfiche: 0-7803-6422-8
	CD-ROM: 0-7803-6423-6

Additional copies of this publication are available from

**IEEE Service Center
445 Hoes Lane
Piscataway, NJ 08854-4150, USA**

+1 800 678 IEEE (+1 800 678 4333)
+1 732 981 1393
+1 732 981 9667 (FAX)
email: customer.service@ieee.org

PES TECHNICAL COMMITTEE PROGRAM CHAIRS

TECHNICAL PROGRAM CHAIR

Anjan Bose

PROGRAM CHAIRS

- Electric Machinery
G. Klempner
- Energy Development and Power Generation
L. Wozniak
- Insulated Conductors
K. Bow
- Power Engineering Education
J. Heydt
- Power System Analysis, Computing and Economics
J. Staron
- Power System Dynamic Performance
J. Paserba
- Power System Instrumentation and Measurement
H. Kirkham
- Power System Operations
P. Traynor
- Power System Planning and Implementation
M. L. Chan
- Power System Relaying
G. Nail
- Power System Communications
F. Cleveland
- Stationary Battery
J. McDowall
- Substations
J. McDonald
- Surge Protective Devices
J. Woodworth
- Switchgear
R. Alexander
- Transformers
H. J. Sim
- Transmission and Distribution
J. Stewart

TABLE OF CONTENTS

VOLUME 1

TRACK 1: OPEN MARKET, SECURITY AND OTHER ISSUES

RELIABILITY INFORMATION IN A COMPETITIVE ENVIRONMENT (PANEL).....	5
Sponsored by: Power System Analysis, Computing & Economics Committee	
Chair: D. Logan, RDI Consulting, USA	

Panelists:

Equipment and System Reliability Data Collection in Canada	5
R. Billington, Canadian Electricity Association	
U.S. Utility Reliability Data	9
D. Logan, RDI Consulting	
GADS and the Competitive Market	10
G. M. Curley, North American Electric Reliability Council	
Reliability Information in a Competitive Market – European Perspective	14
K. Staschus, Deutsche Verbungesellschaft	

POWER SYSTEMS SECURITY ISSUES

Sponsored by: Power System Operations Committee	
Chair: W. L. Snyder, Siemens T&D, USA	
PP Using Adaptive Bounding in Voltage Security Analysis	19
H. Liu, A. Bose, V. Venkatasubramanian, Washington State University	
PP Development of Islanding Early Warning Mechanism for Power Systems	22
M. Tsai, Chinese Culture University	
PP Improving Base Case Solution for On-Line ATC Calculations	27
C. Liu, C. Y. Tsai, C. Su, National Sun Yat-Sen University	
PP Determination of Interface Flow Margin in the Viewpoint of Voltage Stability Analysis using the Modified Continuation Power Flow.....	32
H. Song, S. Kim, B. Lee, S. Kwon, Korea University; V. Ajjarapu, Iowa State University	
PP Enhancement of the Power System Security Level Through the Power Flow Control of the UPFC.....	38
S. Kim, J. Lim, S. Moon, Seoul National University	

ENGINEERING IN CUSTOMER SERVICE PLANNING UNDER CHANGING BUSINESS ENVIRONMENT (PANEL)

Sponsored by: Power System Planning and Implementation Committee	
Chair: M. L. Chan, ML Consulting Group, USA	
Panelists:	
Utility Products and Services Discussion Issues	47
L. Vogt, Mississippi Power Company	
Total Energy Planning	49
W. Sakarias, San Diego Gas & Electric	
Assessing the State of Retail Competition	51
H. Singh, PG&E Energy Services	
Markets for Distributed Generation	52
M. Engel, Midwest Energy, Inc.	

AMR and IT: How Do They Help in Customer Services.....	54
M. L. Chan, ML Consulting Group	
Breakout Sessions to Further Explore Issues Related to Power System Planning under a Changing Business Environment	57
M. L. Chan, ML Consulting Group	

TRACK 2: TECHNOLOGIES FOR THE NEW MILLENNIUM

TRACK 2A – COMPUTER AND CONTROL METHODS

COMPUTER AND ANALYTICAL METHODS SUBCOMMITTEE MEETING	63
Sponsored by: Power System Analysis, Computing & Economics Committee	
Chair: E. Liu, Bechtel Consulting, USA	

Panelist:

Wholesale Power Exchange via Internet.....	64
E. Cazalet, Automated Power Exchange	

DISTRIBUTION SYSTEM CONTROL

Sponsored by: Transmission and Distribution Committee	
Chair: A. Pahwa, ABB, USA	
PP A Novel Architecture for Distribution Management System.....	67
Y. He, Y. Deng, J. Lei, B. Zhang, Tsinghua University	
PP A Parallel Tabu Search Based Method for Network Reconfigurations of Distribution Systems.....	73
H. Mori, Y. Ogita, Meiji University	
PP Modeling the Impact of Automation and Control on the Reliability of Distribution Systems.....	79
Y. He, G. Andersson, The Royal Institute of Technology, Sweden; R. N. Allan, UMIST	
PP Optimal Reactive Power and Voltage Control in Radial Distribution System.....	85
Y. Liu, P. Zhang, Shandong University of Technology; X. Qiu, Shandong Electric Power Company	
PP A Post-Processing Method for Determining the Control Sequence of Distribution Application Functions Formulated using Discrete Load Levels.....	91
K. Miu, J. Wan, Drexel University	
PP A Novel Methodology based on Clustering Techniques for Automatic Processing of MV Feeder Daily Load Patterns.....	96
R. Lamedica, L. Santolamazza, G. Martinelli, A. Prudenzi, University of Rome "La Sapienza"; G. L. Fracassi, ENEL S.p.a., Italy	
PE-018PRD(06-99) Field Results for a Distribution Circuit State Estimator Implementation	102
D. L. Lubkeman, J. Zhang, Clemson University; A. K. Ghosh, Bailey Network Management; R. H. Jones, Rochester Gas and Electric Corp	

APPLICATION OF MODERN CONTROL THEORY TO POWER SYSTEM STABILIZERS

Sponsored by: Energy Development & Power Generation Committee	
Chair: M. Basler, Basler Electric Co., USA	
PP Studies on a Multi-machine Power System with a Neural Network Based Excitation Controller.....	105
M. M. Salem, A. M. Zaki, Electronics Research Institute; O. A. Mahgoub, E. A. El-Zaheb, Cairo University, Egypt; O. P. Malik, Calgary University	
PP A Fuzzy Logic-Based Adaptive Power System Stabilizer for Multi-Machine Systems	111
J. Lu, M. H. Nehrir, D. A. Pierre, Montana State University	

PP Radial Basis Function Based Identifiers for Adaptive PSSs in a Multi-Machine Power System	116
G. Ramakrishna, O. P. Malik, University of Calgary	
PP A Prototype Self-Tuning Adaptive Power System Stabilizer for Damping of Active Power Swings.....	122
A. Eichmann, A. Kohler, J. Taborda, ABB; O.P. Malik, University of Calgary	

IEEE STANDARD DEVELOPMENT FOR INTEGRATED SUBSTATION AUTOMATION COMMUNICATIONS (PANEL)

Sponsored by: Substations Committee
Chair: D. Holstein

Panelists:

Development of and IEEE Standard for Integrated Substation Automation Communication (P1525): Specifications for a Minimum Risk Migration Strategy	129
H. L. Smith	
Development of and IEEE Standard for Integrated Substation Automation Communication (P1525): Specifications for Substation Integrated Protection, Control and Data Acquisition Communications	132
D. K. Holstein	
Development of and IEEE Standard for Integrated Substation Automation Communication (P1525) Specifications for Substation Applications and Key Communication Performance Drivers	136
J. T. Tengdin	
Development of and IEEE Standard for Integrated Substation Automation Communication (P1525): Specifications for Substation Data Model.....	138
M. Lacroix	

SUBSTATION GROUNDING AND INTERNET APPLICATIONS IN POWER SYSTEMS

Sponsored by: Substations Committee
Chair: J. McDonald, Kema Consulting, USA

PP Theoretical Analysis of Grounding Resistance for the Rod Buried into the Multi-layered Earth.....	145
M. Mitani, T. Takahashi, Kanto-Gakuin University	
PP Automatic Maintenance of Substation Ground Resistance.....	151
M. Jambak, H. Ahmad, Universiti Teknologi Malaysia; M. I. Jambak, PT Telekomunikasi Indonesia; A. A. Baker, Oklahoma State University	
PP Thoughts on Future Internet Based Power System Information Network Architecture.....	155
A. Khatib, X. Dong, B. Qiu, Y. Liu, Virginia Tech	

INTELLIGENT SYSTEMS TECHNIQUES FOR DISTRIBUTION SYSTEMS (PANEL)

Sponsored by: Power System Analysis, Computing & Economics Committee
Chair: K. Miu, Drexler University, USA

Panelists:

Intelligent Tools in a Real-World DMS Environment	163
V. Miranda, M. Matos, J. P. Lopes J. T. Saraiva, J. N. Fidalgo, M. T. Ponce de Leão, INESC Porto	
A New Distribution Power Network Restoration Algorithm based on Modern Heuristic Method.....	169
Y. Kaneshige, K. Shimada, K. Takahashi, Toshiba Corporation	
Power Quality Data Analysis: From Raw Data to Knowledge using Knowledge Discovery Approach	172
S. Santoso, J. D. Lamoree, Electrotek Concepts	
Fuzzy Techniques for Load Forecasting	178
G. Lambert-Torres, Escola Federal Engenharia de Itajuba	

SYSTEM CONTROL ISSUES

Sponsored by: Power System Operations Committee
Chair: K. Zadeh, ZME

PP An Autonomous Distributed VQC Method based on Q-TBC	183
M. Tanimoto, Y. Izui, K. Matsuno, Mitsubishi Electric Corp.; N. Fukuta, K. Deno, T. Sasaki, Kansai Electric Power Co.	
PP Inclusion of Combined Cycle Plants into Optimal Resources Scheduling	189
M. R. Bjelogrlic, Siemens PSC	

PP A Security Based Approach for Generating Unit Scheduling.....	195
M. Fotuhi-Firuzabad, R. Billinton, University of Saskatchewan	
Invited Paper PE129PRS(06-99) AGC Logic Based on NERC's New Control Performance Standard and Disturbance Control Standard	201
M. Yao, R. R. Shoultz, The University of Texas at Arlington; R. Kelm, Texas Utilities Electric Company	

NEW STRATEGIES FOR STATION CONTROL

Sponsored by: Energy Development and Power Generation	
Chair: K. Y. Lee, Penn State, USA	
TR7 010 Multiobjective Optimal Power Plant Coordinated Control Operation Through Pressure Set Point Scheduling	205
R. Garduno-Ramirez, K. Y. Lee, Pennsylvania State University	
PP Feedforward Compensated Multiloop Control of a Power Plant	206
R. Garduno-Ramirez, K. Y. Lee, Pennsylvania State University	
PP A Free-Model Based Model Reference Adaptive Inverse Controller Design for a Boiler-Turbine Plant by using Functional Mapping	212
C. Harnold, K. Y. Lee, Pennsylvania State University	
PP Decentralized Online Neuro-Identification of Turbogenerators in a Multi-machine Power System	217
G. K. Venayagamoorthy, ML Sultan Technikon; R. G. Harley, Georgia Institute of Technology	

TECHNICAL OPTIMIZATION AND MODELING

Sponsored by: Power System Analysis, Computing & Economics Committee	
Chair: E. Liu, Bechtel Consulting, USA	
PP Efficient Look-Ahead Load Margin and Voltage Profiles Contingency Analysis using the Tangent Vector Index Method	225
C. Chu, S. Lee, H. Chuang, Chang Gung University	
PP New Branch Overload Elimination Method using Non Linear Programming	231
H. D. Abrantes, C. A. Castro, State University of Campinas	
PP Stochastic Optimal Power Flow: Formulation and Solution.....	237
T. Yong, R. H. Lasseter, University of Wisconsin at Madison	

APPLICATIONS OF GENETIC ALGORITHMS TO POWER SYSTEMS

Sponsored by: Power System Analysis, Computing & Economics Committee	
Chair: Y. Liu, Virginia Tech, USA	
PP GA/SA/TS Hybrid Algorithms for Reactive Power Optimization.....	245
Y. Liu, L. Ma, Shandong University of Technology; J. Zhang, Weifang Electric Power Company	
PP A Genetic-Based Algorithm for Fuzzy Unit Commitment Model.....	250
A. H. Mantawy, King Fahd University of Petroleum and Minerals	
PP A Real Time Approach to Identify Actions to Prevent Voltage Collapse using Genetic Algorithms and Neural Networks	255
J. R. Ferreira, J. A. Lopes, J. T. Saraiva, INESC-Porto	
PP An Approach to Solve the Unit Commitment Problem using Genetic Algorithm.....	261
J. C. Christiansen, C. A. Dortolina, INELECTRA; J. F. Bermudez, Universidad Simon Bolivar	
PE-204PRS (10-99) Development of an Interactive Rule-Based System for Bulk Power System Restoration.....	267
C. Y. Teo, W. Shen, Nanyang Tech University	

POWER PLANT SECONDARY (HIGH SIDE) VOLTAGE CONTROL (PANEL)

Sponsored by: Power System Dynamic Performance Committee	
Chair: C. Taylor, Bonneville Power Admin, USA	
Panelists:	
High Side Voltage Control at Manitoba Hydro.....	271
J. B. Davies, L. E. Midford, Manitoba Hydro	
Improvement of Voltage Stability by the Advanced High Side Voltage Control Regulator.....	278
M. Shimomura, H. Kitamura, J. Paserba, Mitsubishi	

Excitation Control for High Side Voltage Regulation	285
A. Murdoch, J. J. Sanchez-Gasca, M. J. D'Antonio, R. A. Lawson, General Electric	
Secondary Coordinated Voltage Control System: Feedback of EDF.....	290
H. Lefebvre, D. Frangnier, J. Y. Boussion, P. Mallet, M. Bulot, EDF	
The Secondary Voltage Regulation in Italy	296
S. Corsi, CESI	
The New CIGRE Task Force on Coordinated Voltage Control in Transmission Networks	305
N. Martins, CEPEL	
Line Drop Compensation, High Side Voltage Control, Secondary Voltage Control – Why Not Control a Generator Like a Static Var Compensator?	307
C. W. Taylor, Bonneville Power Administration	

SYSTEM ECONOMICS ISSUES

Sponsored by: Power System Operations Committee
Chair: M. E. El-Hawary, Dalhousie University, Canada

PP Short-Term Scheduling of Inter-Utilities Power-Exchange in Re-structured Markets	313
V. H. Quintana, University of Waterloo, J. Aguado, University of Malaga	
PP Supply Reliability Cost Allocation under Deregulated Generation Market.....	319
S. Niioka, N. Okada, R. Yokoyama, Tokyo Metropolitan University	
PP Economic Transaction due to Primary and Secondary Regulation of Frequency in Argentina: .	
Methods and Experience	325
J. L. Aguero, M. C. Beroqui, R. Molina, Facultad De Ingenieria, UNLP	
PP UPFC Operation for the Minimization of Power Production and Delivery Costs	331
J. Lim, S. Moon, Seoul National University	

ADVANCED POWER SYSTEM CONTROL USING INTELLIGENT SYSTEMS (PANEL)

Sponsored by: Power System Analysis, Computing and Economics Committee
Chair: K. Tomsovic, Washington State University, USA

Panelists:

Advanced Power System Control using Intelligent Systems	336
K. Tomsovic, Kumamoto University; D. M. Falcão, Federal University of Rio de Janeiro	
Online Dynamic Security Assessment: Implementation Problems and Potential Use of Artificial Intelligence	340
J. L. Jardim, BC Hydro	
Using a Neural Network to Predict the Dynamic Frequency Response of a Power System to an Under-Frequency Load Sheding Scenario.....	346
M. A. Mitchell, J. A. Lopes, J. N. Fidalgo, INESC Porto; J. D. McCalley, Iowa State University	
Intelligent System Applications to Emergency Control.....	352
L. Wehenkel, University of Liege	
Control Center Operations and Training under Deregulation: A New Zealand Example.....	358
R. K. Rayudu, A. Maharaj, National Coordination Center New Zealand	

THE HOME PAGE AS ENTRY TO THE AUTOMATED SUBSTATION (PANEL)

Sponsored by: Substations Committee
Chair: D. A. Johnson, Southwest Power, USA

Panelists:

Using Internet Technology for Secure Substation Access and Control	363
T. Shaw, Hathaway Corp	
The Substation, the PC and the Internet.....	369
A. H. Hamdon, SUBNET Solutions	
Corporate Information Access using Internet Browsers.....	375
J. W. Evans, DTE Energy	

TRACK 2B – POWER SYSTEM OPERATIONS

POWER SYSTEM DYNAMIC MODELING - TECHNICAL PAPER SESSION

Sponsored by: Power System Dynamic Performance Committee
Chair: B. C. Lesieutre, MIT, USA

PP Combining Power System Load Models at a Busbar.....	383
T. Shimada, S. Agematsu, T. Shoji, Tokyo Electric Power Co.; T. Funabashi, H. Otoguro, Meidensha Corporation; A. Ametani, Doshisha University	
PP Determination of Static Load Models from LTC and Capacitor Switching Tests	389
Y. Baghzouz, University of Nevada; C. Quist, Nevada Power Company	
PP Effect of Load Modeling on Voltage Stability.....	395
S. Zhu, J. H. Zhen, Tsinghua University; L. Li, University of California; S. D. Shen, G. M. Luo, Tsinghua University	
PP Robust Solutions for the Interaction Between Dynamic Loads and FACTS Controllers	401
S. Ammari, Y. Besanger, N. Hadjsaid, D. Georges, INPG	
PE-071PRS (04-2000) A Model of Fossil Fueled Plant with Once-Through Boiler for Power System Frequency Simulation Studies.....	407
T. Inoue, H. Tanguchi, CRIEPI; Y. Ikeguchi, Kansai Electric Power Co.	
PE-054PRS (04-2000) Identification-Based Power Unit Model for Load-Frequency Control Purposes.....	408
Y. Hain, R. Kulessky, G. Nudelman, The Israel Electric Corporation	

DISTRIBUTION FAULTS

Sponsored by: Transmission & Distribution Committee
Chair: E. Perander, USA

PP Fault Restoration Algorithm using Fast Tracing Technique based on the Tree-Structured Database for the Distribution Automation System.....	411
Y. Moon, B. Cho, H. Ryu, H. Park, Yonsei University; B. Ha, S. Lim, KEPRI	
PP Fault Diagnosis in Distribution Substations using CE-Nets via Boolean Rule Matrix Transformations	416
W. Chen, Taiwan Power Company; C. Liu, National Taiwan University; M. Tsai, Chinese Culture University	
PP Particular Characteristics Associated with Temporary and Permanent Fault on the Multi-Shot Reclosing Scheme....	421
J. Oh, S. Yun, J. Kim, Soongsil University; E. Kim, KERI	
PP A Novel ANN Fault Diagnosis System for Power Systems using Dual GA Loops in ANN Training	425
T. Bi, Y. Ni, C. M. Shen, F. F. Wu, The University of Hong Kong	
PP Feeder Reconfiguration for Distribution System Contingencies by Object Oriented Programming	431
C. S. Chen, C. Wu, National Sun Yat-Sen University; C. Lin, M. S. Kang, Kao Yuan Institute of Technology	
PP Analysis of Power System Transient Disturbances using an ESPRIT-based Method	437
C. J. Dafis, A. Petropulu, C. O. Nwankpa, Drexel University	
PP A Fault Locator for Radial Subtransmission and Distribution Lines	443
R. Das, ABB Automation; T. S. Sidhu, M. S. Sachdev, University of Saskatchewan	
PP Radial Distribution System Short Circuit Analysis with Lateral and Load Equivalencing: Solution Algorithms and Numerical Results	449
Y. Mao, K. Miu, Drexel University	

INSULATED CONDUCTORS AND ACCESSORIES (PAPER)

Sponsored by: Insulated Conductors Committee
Chair: K. Bow, Dow Chemical Company, USA

PP Underground Power Cable Environment On-Line Monitoring and Analysis	457
J. Lyall, G. Nourbakhsh, H. C. Zhao, Queensland University of Technology	
PP Determination of Moisture Content in Mass Impregnated Cable Insulated using Low Frequency Dielectric Spectroscopy	463
R. Neimanis, Royal Institute of Technology; T. K. Saha, University of Queensland; R. Eriksson, Royal Institute of Technology	

PP Development of Cold Shrinkable Joints for EHV Cables.....	469
H. Suzuki, S. Kobayashi, T. Ono, D. Muto, S. Tanaka, H. Kurihara, H. Nomura, The Furukawa Electric Co., Ltd.	
PP Study of Partial Discharge Localization Method for EHV Prefabricated Joint.....	475
C. Min, K. Urano, A. Kato, Y. Sakaguchi, G. Okamoto, H. Ueno, K. Hirotu, A. Jinno, Sumitomo Electric Industries; M. Okada, N. Yoshikawa, T. Ito, Kansai Electric Power Company	
PP Investigation of Elbow and Insulated Bushing Cap Flashovers during Unloaded Switching	480
R. A. Walling, GE Power Systems Energy Consulting; G. B. Shattuck, Alabama Power Company; J. Lazar, North State Power Company; D. Komassa, Wisconsin Electric Power Company	

OPERATIONAL METHODS PAPER SESSION

Sponsored by: Power System Operations Committee
 Chair: E. Vahedi, Perot Systems, USA

TR8-017EF A Security-Constrained Energy and Spinning Reserve Markets Clearing System using an Interior-Point Method.....	489
M. Madrigal, Univ. of Waterloo; V. H. Quintana, Instituto Tecnologico de Morelia	
PP Estimating Reactive Margin for Determining Transfer Limits	490
L. Chen, A. Bose, K. Tomsovic, Washington State University; R. Stuart, Pacific Gas and Electric	
PP Real-Time Load Forecasting by Artificial Neural Networks	496
S. S. Sharif, J. H. Taylor, University of New Brunswick	
PP Component Level Cascade Control of UPFC	502
Y. Kang, G. B. Shrestha, T. T. Lie, Nanyang Technological University	
PP Application of Stochastic Programming for Available Transfer Capability Enhancement using FACTS Devices	508
Y. Xiao, Y. H. Song, Brunel University; Y. Z. Sun, Tsinghua University, China	
PP Dispatch Optimization Incorporating Transient Voltage Stability Constraints.....	516
D. Chattpadhyay, Univ. of Canterbury; D. Gan, ISO New England	
PP Fast Critical Clearing Time Estimation of a Large Power System using Neural Networks and Sobol Sequences	522
S. Jiriwibhakorn, A. H. Coonick, Imperial College	

POWER SYSTEM STABILITY SUBCOMMITTEE MEETING WITH IMBEDDED TECHNICAL PRESENTATIONS

Sponsored by: Power System Dynamic Performance Committee
 Chair: J. Paserba, Mitsubishi Electric, USA

PP Criteria and Methodologies Established in the Ambit of GTAD/SCEL/GCOI Voltage Collapse Task Force for Voltage Stability in the Brazilian Interconnected North/Northeast, South/Southeast and North/South Interconnected Systems	531
A. C. Martins, FURNAS; H. J. Pinto, CEPEL; L. F. Vasconcelos, CHESF; P. Almeida, ELETROBRAS; N. H. Brito, ELETRO NORTE; V.L. De Castro Soares, ELETROSUL; S. Yagi, EPTE; L. C. Ferreira, L. M. Carijo, FURNAS; R. Jovita, ITAIPU; R. Prada, PUC-RJ; F. dos Santos Fonseca, CPTEE	
PP Transmission Voltage Recovery Following a Fault Event in the Metro Atlanta Area.....	537
L. Y. Taylor, S. Hsu, Southern Company Services Inc.	
Special Invited Paper Competitive Procurement of Dynamic Reactive Power Support Service for Transmission Access	543
W. Xu, Y. Zhang, L. C. P. da Silva, University of Alberta; P. Kundur, Powertech Labs	

DISTRIBUTION MAINTENANCE TECHNOLOGIES (PANEL)

Sponsored by: Transmission and Distribution Committee
 Chair: C. Williams, Fla. Power Corp., USA

Panelists:	
Reliability Centered Maintenance for Distribution Underground Systems.....	551
W. Reder, D. Flaten, Ultra Power Corp	
Cable Remediation Program Cost Management using Silicone Injection.....	557
C. Jaeger, Pudget Power	
Asset Management for the Distribution Pole Plant-Closing the Performance Gap Between Traditional Maintenance and Asset Management.....	561
R. Butura, Osmose	

Applying Reliability Centered Maintenance (RCM) to Overhead Electric Utility Distribution Systems	566
J. Goodfellow, ECI Inc.	

IEEE TELECOMMUNICATIONS FOR SUBSTATION AUTOMATION (PANEL)

Sponsored by: Substations Committee

Chair: J. W. Evans, Detroit Edison, USA

Panelists:

A Survey of Substation Communications Technology	573
P. J. Zawada, American Electric Power	
A Network-Less Automation Implementation – Case Study	579
C. E. Jackson, J. W. Evans, DTE Energy	
Telecommunication Services for Utility Owners	583
K. Cooley, Tampa Electric Power	
Beyond P.O.T.S	585
C. Johnson, Hathaway Corp	
Communication Infrastructure and Substation Automation Communications Planning Issues	589
C. W. Newton	

POWER FLOW COMPUTATION

Sponsored by: Power System Analysis, Computing & Economics Committee

Chair: E. Liu, Bechtel Consulting, USA

PP A New Method of Finding Low-Voltage Power Flow Solutions.....	593
R. P. Klump, Powerworld Corporation; T. J. Overbye, University of Illinois at Urbana-Champaign	
PP Techniques for Improving Power Flow Convergence	598
R. P. Klump, Powerworld Corporation, T. J. Overbye, University of Illinois at Urbana-Champaign	
PP Direct Computations of Critical Clearing Time using Trajectory Sensitivities	604
T. B. Nguyen, M. A. Pai, University of Illinois; I. A. Hiskens, University of Illinois at Urbana-Champaign	
PP Iterative Solver Techniques in the Dynamic Simulation of Power Systems	609
D. Chaniotis, M. A. Pai, University of Illinois	
PP Saddle-Node Bifurcations of Voltage Profiles of Small Integrated AC/DC Power Systems.....	614
Y. K. Fan, H. G. Kwatny, D. Niebur, C. O. Nwankpa, Drexel University; R. Fischl, F&H Applied Science Assoc., Inc.	

TRANSMISSION PLANNING UNDER FERC ORDER 2000 (PANEL)

Sponsored by: Power System Planning and Implementation Committee

Chair: M. Bauman, ABB, USA

Panelists:

Reliability Indices	623
M. Henderson, ISO New England	
Setting Reliability Goals	625
E. Mayer, ABB Power Distribution Solutions	
System Operator Responsibility in the De-regulated Industry	628
H. Chao, ABB Electric Systems Consulting	
Reliability and Contingency Criteria for Planning.....	630
R. Powell, Penn State University	
Impact of Independent Power Producers (IPP'S) and Non-Utility Generators (NUGS) on Entergy's Transmission System	633
S. Kolluri, D. Powell, K. Tinnium, Entergy	

TRANSMISSION OPERATIONS ISSUES

Sponsored by: Power System Operations Committee
Chair: R. J. Kafka, Potomac Electric Power, USA
M. E. Long, Long Consulting

9:00AM – 9:30AM Business Meeting of the Transmission Operations Subcommittee

9:30AM – 12:00PM Operator Training Working Group

DIGITAL EXCITATION SYSTEMS AND EXCITATION SYSTEMS SUBCOMMITTEE

Sponsored by: Energy Development & Power Generation Committee
Chair: L. Wozinak, University of Illinois, USA

PP Functional Testing of a New Digital Excitation System.....	637
C. A. Morse, I. A. Gibbs, R. F. Martinez, C. R. Mummert, Eaton/Cutler-Hammer; T. Reynolds, Carolina Power and Light	
PP New Multi-Processor Digital Excitation System	643
I. Gibbs, R. F. Martinez, C. A. Morse, C. R. Mummert, Eaton/Cutler-Hammer; E. C. Prather, Nexus Technologies	
AUTHOR INDEX.....	follows page 648

VOLUME 2

COMPLEX INTERACTIVE NETWORKS/SYSTEMS

Sponsored by: Power System Analysis, Computing & Economics Committee
Chair: M. Amin, EPRI, USA

Adaptive Intelligent Agents: Application to Self-healing Electric Power Grid	651
M. Amin, EPRI	

Panelists:

Bernard Lesieurte, MIT
James McCalley, Iowa State University
David Pepyne, Harvard University
Sarosh Talukdar, Carnegie Mellon University
Lefteri Tsoukalas, Purdue University

STABILITY ANALYSIS

Sponsored by: Power System Analysis, Computing & Economics Committee
Chair: E. Liu, Bechtel Consulting, USA

PP Improved Method of Maximum Loadability Estimation in Power Systems by Transforming the Distorted P-E Curve	657
Y. Moon, B. Choi, B. Cho, Yonsei University	
PP Extended Noniterative Algorithm using the Two-Axis Generator Models for Transient Stability Analysis	663
B. Cho, B. Choi, J. Lee, Y. Moon, Yonsei University	
PP The Steady State Characteristics of a STATCOM with Energy Storage	669
Z. Yang, C. Shen, L. L. Zhang, M. L. Crow, University of Missouri - Rolla	
PP An Application of Linear Matrix Inequality Method for Power System Transient Stability Analysis	675
A. Halim, Tokyo Institute of Technology; K. Takahashi, CRIEPI	

TIME DOMAIN AND FREQUENCY ANALYSIS

Sponsored by: Power System Analysis, Computing & Economics Committee
Chair: E. Liu, Bechtel Consulting, USA

PP Estimation of Time-Varying Voltage Phasor and Frequency during Emergency Operating Conditions.....	683
Y. Lu, A. Abur, Texas A&M University	

PP	Wavelet-Based Simulation of Transients along Transmission Lines with Frequency Dependent Parameters	689
	F. H. Magnago, A. Abur, Texas A&M University	
PP	A Comprehensive Simulation Program for a Subsynchronous Resonance Analysis.....	695
	X. Lei, B. Buchholz, E. Lerch, D. Povh, D. Retzmann, Siemens AG	

ENERGY CONTROL CENTER SUBCOMMITTEE ISSUES (PANEL)..... 703

Sponsored by:	Power System Operations Committee
Chair:	E. Dobrowolski, KEMA Consulting, USA
	P. Traynor, ABB, USA
	H. Boscher, Evans Consoles, USA

9:00AM – 12:00PM Innovative User Interface Technologies

2:00PM – 5:00PM New Concepts in AGP

PP	Bilateral Market for Load Following Ancillary Services.....	704
	E. Nobile, A. Bose, K. Tomsović, Washington State University	
PP	Generation Control for Deregulated Electric Power Systems	707
	R. P. Schulte	

CONSULTING ENGINEER DC TRANSMISSION

Sponsored by:	Transmission & Distribution Committee
Chair:	A. Gole, Univ. Manitoba, CANADA

PP	HVDC Transmission System using Voltage Source Converters - Design and Applications.....	715
	F. Schettler, H. Huang, N. Christl, Siemens AG	
PP	Probabilistic Modeling of Harmonic Currents Produced by a Twelve-Pulse AC/DC Converter under Unbalanced Supply Voltage.....	721
	E. Ngandui, E. J. Mohammed, A. Cheriti, P. Sicard, Universite Du Quebec à Trois-Rivieres	
PP	Calculations of Diversified Harmonic Currents in Multiple Converter Systems.....	727
	Y. G. Hegazy, Ain Shams University, M. M. Salama, University of Waterloo	

TRACK 2C – POWER SYSTEM PERFORMANCE

GENERAL SYSTEMS - HARMONICS I

Sponsored by:	Transmission & Distribution Committee
Chair:	A. Imece, ABB, USA

PP	Analysis and Elimination of Third Harmonic Oscillation in Capacitor Voltages of 3-Level Voltage Source Converters	737
	M. Mohaddes, D. Brandt, Brandt Consultants Inc.; K. Sadek, Siemens AG	
PP	Effectiveness of Resonant Harmonic Filters and Its Improvements	742
	L. S. Czarnecki, H. Ginn, Louisiana State University	
PP	Mitigation of Harmonic in Oil Field Electric Systems using Multiple Low Voltage Filters	748
	C. Muskens, D. Bochaichuk, ATCO Electric Ltd.; W. Xu, University of Alberta	
PP	Reducing Harmonics in Multiconverter Systems under Unbalanced Voltage Supply - A Novel Transformer Topology.....	753
	G. Paulillo, C. A. M. Guimaraes, GQEE - Power Quality Study Group; J. Policarpo, G. Abreu, R. A. Oliveira, Worcester Polytechnic Institute	

MODELING TOOLS FOR SYSTEM TRANSIENTS (PANEL) 761

Sponsored by:	Transmission & Distribution Committee
Chair:	A. M. Gole, University of Manitoba, CANADA

Panelists:

Time Domain Electromagnetic Transients Programs.....	763
J. A. Martinez- Univ. of Catalunya	

Real Time Digital Electromagnetic Transients Simulation of Power Systems	765
T. L. Maguire, RTDS Technologies	
MATLAB/Simulink and PSpice as Modelling Tools for Power Systems and Power Electronics.....	766
H. Le-Huy, Laval University; G. Sybille, IREQ	
Merging, Prototyping and Hybrid Tools for Power System Transient Simulation	768
J. Mahseradjian, IREQ	

A QUEST FOR EFFECTIVE METHODS OF HARMONIC SUPPRESSION AND ITS INSTRUMENTATION (PANEL)

Sponsored by: Power System Instrumentation & Measurement Committee
Chair: E. So, Natl. Res. Council of Canada, CANADA

Panelists:

Nonlinear Passive Filters.....	773
D. Zaninelli, Politecnico di Milano	
Load Characteristics and Harmonic Analysis of DC Arc Furnace.....	778
C. -J. Wu, T. -H. Fu, Y. -J. Chen, National Taiwan University of Science and Technology	
Resonant Harmonic Filters: Their Optimization and Limits of Effectiveness	783
H. Ginn, Louisiana State University	
Harmonic Blocking Compensator with Adaptive Minimization of Reactive and Unbalanced Currents	789
S. -M. Hsu, Southern Company Services; L. S. Czarnecki, Louisiana State University	
Design Aspects of Harmonic Filters for High-Power AC/DC Converters.....	795
P. Mattavelli, University of Padova	
An Overview of Methods of Harmonic Suppression in Distribution Systems.....	800
L. S. Czarnecki, Louisiana State University	

RECENT APPLICATIONS OF SMALL SIGNAL STABILITY ANALYSIS TECHNIQUES (PANEL)

Sponsored by: Power System Dynamic Performance Committee
Chair: J. J. Sanchez-Gasca, GE-PSEC, USA

Panelists:

Using the Coherency Function in Measurement Based Small-Signal Analysis of Large Power Systems	809
J. F. Hauer, Pacific N.W. National Laboratory; D. J. Trudnowski, Montana Tech	
Small Signal Stability of a Large Power System as Affected by New Generation Additions.....	812
S. Arabi, P. Kundur, Power Tech Labs; P. Hassink, D. Matthews, Central & SouthWest Services	
Using MIMO System Identification for Modal Analysis and Global Stabilization of Large Power Systems	817
I. Kamwa, Hydro-Quebec	
High Frequency Eigenanalysis of HVDC and FACTS Assisted Power Systems	823
L. A. S. Pilotto, J. E. R. Alves, CEPEL; E. H. Watanabe, Federal University of Rio de Janeiro	
Eigenvector Assignment in Power System Controller Design: Illustration Through Predatory Control	830
C. L. DeMarco, University of Wisconsin-Madison	
Nonlinear Computation and Control for Small Disturbance Stability.....	836
D. J. Hill, Z. Dong, University of Sidney	
Study of Unstable Limit Cycles in Power System Models	842
J. Li, V. Venkatasubramanian, Washington State University	

GENERAL SYSTEMS - TRANSIENTS I

Sponsored by: Transmission and Distribution Committee
Chair: R. Hauth, NYCAP, USA

PP Effect of Dispersion on Disturbance Propagation on High Voltage Transmission Lines	851
Y. Shin, W. M. Grady, S. C. Bhatt, C. Siddharth, E. J. Powers, The University of Texas at Austin	
PE-212-PRD (01-2000) Analytical and Experimental Study on Surge Response of Transmission Tower	855
H. Motoyama, H. Matsubara, CRIEPI	
PE-010PRD (09-99) Highly-Accurate Modeling of Frequency-Dependent Balanced Transmission Lines.....	856
C. Dufour, H. Le-Huy, Laval University, Canada	
PE-011a-PRD(01-2000) Fault Analysis on AC/HV Cable Transmission Lines	857
D. Zaninelli, Politecnico di Milano; G. Ballocchi, Tenax S.p.A.	

GENERAL SYSTEMS - HARMONICS II

Sponsored by: Transmission and Distribution Committee
Chair: M. F. McGranahan, Electotek Concepts, USA

PP Filter Design using a Newton-Raphson Method based on Eigenvalue Sensitivity	861
S. L. Varicchio, N. Martins, CEPEL	
PP Harmonic Compensation for Three-Phase Adjustable Speed Drives using Active Power Line Conditioner	867
A. M. Al-Zamil, Kuwait University; D. A. Torrey, Rensselaer Polytechnic Institute	
PP Power Direction Method Cannot Be Used for Harmonic Source Detection.....	873
W. Xu, University of Alberta	

STATISTICS IN TRANSIENT ANALYSIS (PANEL)

Sponsored by: Transmission and Distribution Committee
Chair: J. Mahseredjian, Hydro-Quebec, Canada

Panelists:

Statistical Methods for Evaluating Lightning Induced Effects on Distribution Lines.....	879
A. Borghetti, C. A. Nucci, M. Paolone, Univ. of Bologna	
Estimation Techniques for Risk of Failure.....	880
A. Xemard, Electricite de France, E. Tarasiewicz, Ontario Hydro Services; R. Lambert, Electricite de France	
Statistical Assessment of Very Fast Transient Overvoltages in Gas Insulated Substations	882
J. A. Martinez, Univ. de Catalunya; R. Natarajan, ABB Power T&D Co.; E. Camm, S&C Electric Co.	
Comparison of Statistical Switching Results using Gaussian, Uniform, and Systematic Switching Approaches	884
J. A. Martinez, Univ. de Catalunya	
On Automating Lightning Analysis Methods	890
J. Mahseredjian, IREQ; A. Xemard, Electricite de France; N. Qako, IREQ	
Energization of a No-Load Transformer for Power Restoration Purposes: Sensitivity to Parameters	892
M. Rioual, C. Sicre, Electricite de France	

FOUR POSSIBLE APPROACHES TO ESTABLISHMENT OF VOLTAGE SAG INDICES (PANEL)

Sponsored by: Transmission and Distribution Committee
Chair: M. T. Sheehan, Puget, USA

Panelists:

Characterization of Three-Phase Unbalanced Dips (as easy as one-two-three?)	899
M. H. J. Bollen, E. Styvaktakis, Chalmers University of Technology	
Power Acceptability and Voltage Sag Indices in the Three Phase Sense.....	905
R. Thallam, Salt River Project; G. T. Heydt, Arizona State University	
Source Identification for Voltage Sag and Flicker	911
B. Hughes, B.C. Hydro	
Power Quality Performance Component of the Special Manufacturing Contracts Between Energy Provider and Customer	912
A. Dettloff, DTE Energy	

MARKET SIMULATION AND OPTIMIZATION (PANEL)

Sponsored by: Power System Operations Committee
Chair: V. Quintana, Univ. of Waterloo, CANADA

Panelists:

Optimization Models in Transmission Markets	915
P. Gribik, Perot Systems, J. Kriikson, California Power Exchange	
The Role of Analytical Modeling and Software in California's Deregulated Electricity Markets.....	916
A. Papalexopoulos, ECCO Intl.	
Market Power Issues in Bid-Based Hydro Dispatch	917
M. Pereira, L. A. N. Barroso, R. Kelman, PSRI	
Optimal Response of an Oligopolistic GENCO to a Competitive Electricity Market	918
A. Conejo, Univ. Castilla-La Manch, Spain	

Competitive Market Simulator.....	919
G. J. Anders, Ontario Power Technologies	
Simulation and Optimization Methods for Market Behavior.....	920
N. Rau, ISO New England	

**POWER SYSTEM STABILITY CONTROLS SUBCOMMITTEE BUSINESS MEETING WITH IMBEDDED
TECHNICAL PAPER SESSION**

Sponsored by: Power System Dynamic Performance Committee
 Chair: C. P. W. Taylor, Bonneville Power, USA
 B. H. Chowdhury, University of Missouri

8:00AM – 9:30AM Business Meeting

9:30AM – 12:00PM Imbedded Paper Session

PE-007PRS (04-2000) Decentralized Stabilizing Control of Synchronous Generator.....	923
J. Machowski, S. Robak, Warsaw University of Technology; J. W. Bialek, J. R. Bumby, University of Durham; N. Abi-Samra, Electrical Power Research Institute	
PE-041-PRS (12-99) A Comparison of Classical, Robust, and Decentralized Control Designs for Multiple Power System Stabilizers	924
J. H. Chow, S. Wang, G. E. Boukarim, Rensselaer Polytechnic Inst.; G. N. Taranto, COPPE; N. Martins, CEPEL	
PP Power System Stabilizer Tuning - Simulations and Commissioning.....	925
W. Gu, P. Eng, ATCO Electric; P. Smulders, ABB; K. Mushens, ATCO Electric	
PP Quantifying Proximity to Voltage Collapse using the Voltage Instability Predictor (VIP).....	931
D. E. Julian, W. H. Quaintance, K. T. Vu, ABB, D. Novosel, ABB Automation Group Ltd.; R. P. Schulz, N. B. Bhatt, American Electric Power	
PP Benefits of Applying Secondary Voltage Control Schemes to the Brazilian System.....	937
G. N. Taranto, D. M. Falcao, COPPE/UFRJ; N. Martins, CEPEL; A. C. B. Martins, Furnas Centrais Eletricas S.A.; M. G. Dos Santos, ONS	

GENERAL SYSTEMS - TRANSIENTS II

Sponsored by: Transmission & Distribution Committee
 Chair: E. H. Camm, S & C Electric Company, USA

PP A Frequency Domain Procedure for Locating Switched Capacitors in Power Distribution Systems.....	945
W. M. Grady, J. Kim, A. Arapostathis, J. Soward, The University of Texas at Austin; S. C. Bhatt, EPRI	
PP Computation of Continuous Wavelet Transform via a New Wavelet Function for Visualization of Power System Disturbances	951
S. Huang, C. Hsieh, National Cheng Kung University	
PP Effect of Nonlinearity and Unbalance on Power Factor	956
D. P. Manjure, E. B. Makran, Clemson University	

NON-PERIODIC CURRENTS: THEIR IDENTIFICATION AND COMPENSATION (PANEL)

Sponsored by: Power System Instrumentation & Measurement Committee
 Chair: L. S. Czarnecki, Louisiana State University, USA

Panelists:

Active Filters and Energy Storage Systems Operated under Non-Periodic Conditions	965
H. Akagi, Tokyo Institute of Tech	
Non-Periodic Current: Their Properties, Identification and Compensation Fundamentals	971
L. S. Czarnecki, Louisiana State Univ	
High Performance Active Filters using Selective Harmonic Control	977
P. Mattavelli, P. Tenti, Univ. of Padova	
Compensation of Non-active Current in Power Systems – Definitions from Compensation Standpoint	983
F. Z. Peng, Oak Ridge Natl. Labs	
Compensation of Non-active Current in Power Systems – Definitions from Compensation Standpoint	983
L. M. Tolbert, Univ. of Tennessee	