

POWER SYSTEMS AND POWER PLANT CONTROL 1989

*Selected Papers from the IFAC Symposium,
Seoul, Korea, 22–25 August 1989*

Edited by

UHI AHN

*Korea Electrotechnology Research Institute,
Chang-Won City, Korea*

Published for the

INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL

by

PERGAMON PRESS

Member of Maxwell Macmillan Pergamon Publishing Corporation

OXFORD · NEW YORK · BEIJING · FRANKFURT
SÃO PAULO · SYDNEY · TOKYO · TORONTO

CONTENTS

INVITED PAPERS

Reactive Power and System Operation - Incipient Risk of Generator Constraints and Voltage Collapse J. GOOSSENS	1
Recent Progress in Practice, Development and Research on Software Engineering (An Aspect Toward Power Systems and Power Plant Control) Y. MATSUMOTO	11
Expert Systems in Energy Management Systems B.F. WOLLENBERG	19
Evolution of Energy Management Systems R.D. MASIELLO	25

SECURITY ANALYSIS TECHNIQUES

Sensitivity and Partial Re-factorization Techniques for Simulating Outages of Transmission Lines M.S. SACHDEV, R.J. FLEMING, O.A. KOMOLAFE	31
Critical Review of Branch Contingency Selection Methods V. BRANDWAJN, M.GILLES, M.G. LAUBY	37

NORMAL AND EMERGENCY GENERATION CONTROL

A Practical Decentralized LFC System with Generation Rate Limit H. SASAKI, N. YORINO, R. YOKOYAMA, Y. TAMURA	43
Robust Load Frequency Control E. TANAKA, J. HASEGAWA	49
Control of Hydroelectric Power Plants on the River Guadalupe A. WEIBULL, S. HOGBERG	55
Security Control of Small Longitudinal Systems K. KARNASUTA, C. TREEWITTAYAPOOM, A. TIRANUCHIT	61
Evaluating Closed Loop Fast Valving Performance in Power Plants Y. XIAOSHI, B. DELFINO, G.B. DENEGRI, M. INVERNIZZI, P. PINCETI	67

REACTIVE POWER AND VOLTAGE SCHEDULING

- Optimal Reactive Power Planning, Part I - Load Level Decomposition 73
J.B. KIM, K.J. KIM, Y.M. PARK
- A Global Approach for Var/Voltage Management 81
L.D.B. TERRA, M.J. SHORT

NETWORK MODELING AND ANALYSIS

- Network Partition in Power Systems 87
N. MULLER, V.H. QUINTANA
- Fast Initial Estimation of Power System Eigenvalues 93
Y. XUE, M. SHI, Y. CHAI
- Decentralized Computation of Eigen Value for Large Power System 99
M. OSANO
- A Flexible Method Detecting Network Clusters for Emergency Control 105
T. SANNES

REAL POWER DISPATCH AND UNIT COMMITMENT

- Security Constrained Dispatch with Post-Contingency Corrective
Rescheduling Using Linear Programming 111
C.H. CHEUNG, M.J.H. STERLING, M.R. IRVING
- Development of Optimal Power Flow and Application to Dynamic Economic
Load Dispatch 117
H. SASAKI, J. KUBOKAWA, N. YORINO, R. YOKOYAMA
- Lagrangian Relaxation Method for Long-term Unit Commitment 123
K. AOKI, K. NARA, T. SATOH, M. ITOH

NETWORK POWER FLOWS

- Multimethod Optimal Power Flows at Electricite de France 129
J.L. CARPENTIER, A. GILLON, Y. JEGOZO, A. CANDRE, F. CARAMAN, C. PELLEN,
P. TOURNEBISE
- An Efficient NLP Algorithm of SQP Type Suitable to OPF Computation of
Controlling Sub-space Type 135
TANG YI
- Optimal Power Flow Experience in an Energy Management System 141
L.J. JARRIEL, S. VEMURI, D.C. RUSH, C. LETTER

SYSTEM DYNAMICS AND STABILITY ANALYSIS

- Determination of Interface Flow Stability Limits by Sensitivity Analysis
of Transient Energy Margin 147
C. HWANG, V. VITTAL, A.A. FOUAD

A Control Strategy for the AC/DC Power System Under Large Disturbances WANG FU-YING, CHEN-XUN	153
Effects of Load Characteristics on the Transient Stability of KEPCO's System JAEHYEON GIM, TSUTOMU OYAMA, MO-SHING CHEN, GEUN-JOON LEE, KWANG-IN KIM, TAE-WON KWON	159
A New Approach to Mid and Long-Term Power System Analysis J.C. KIM, Y.M. PARK, B.H. KIM	165
Feature Extraction of Line Flow Fluctuation and Its Application to Dynamic Security Diagnosis H. SAITOH, J. TOYODA, O. ISHIOKA, S. OBARA, Y. KOBAYASHI	171
Electromechanical Distances for Identifying Contingency Propagation in Transient Stability Studies R. BELHOMME, M. PAVELLA, Y. XUE	177
A New Coherence Approach of Generators for Investigation of Slow and System Wide Oscillations in Large Power Systems B.E. ELIASSON, S.O.R. LINDAHL	183
A Control Measure for Preventing Auto-Parametric Resonance in Power Systems N. YORINO, K. KUBO, H. SASAKI, Y. TAMURA	189

RELIABILITY AND PRODUCTION COSTING

Fuzzy Optimization for Economy-Security Coordination in Power System Planning R. YOKOYAMA, K. YASUDA, K. OKADA, R. TANABE, H. SASAKI	195
Expected Power System Production Costs Using Large Deviation and Mixture of Normals Approximations M. MAZUMDAR, C.K. YIN	201
Probabilistic Production Costing Simulation Model Based on the Real Economic Dispatch B.Y. LEE, K.B. SHIM, J.R. SHIN	207

MODELING AND CONTROL OF POWER PLANTS

Advanced Techniques in Automation of Fluidized Bed Boilers U. KORTELA, J.P.PYYKKO, M.A. TUOVINEN, S. HOLM	213
On the Multivariable Robust Control of a Boiler-Turbine System W.H. KWON, S.W. KIM, P.G. PARK	219
A Hierarchical Expert System for Failure Diagnosis in Power Plants P. LAUTALA, M. VALISUO	225
Variable Structure Control of Water Turbine Governing System Y.M. ZENG, O.P. MALIK, G.S. HOPE	231

GENERATION AND INTEGRATED EXPANSION PLANNING

Fuzzy Decision-Making on Electric Energy Strategy for Long-term Generation Expansion Planning H. SATOH, Y. SERIZAWA	237
Power System and Cogeneration: An Optimal Expansion Planning Y.H. KWUN	243
Reliability Evaluation of Generation Systems Including Energy Limited Units - A Cluster Based Approach QUAN CHEN, C. SINGH	249
Power System Modelling and Simulation for Integrated System Expansion Planning O.J. BOTNEN, N. FLATABO, A. HAUGSTAD, K.S. HORNNES, A. JOHANNESSEN	255
An Advanced Integrated System for Electric Energy Supply Planning T. MINAKAWA, K. TAGATA	261

EMS CONTROL CENTERS

New Computer Configuration and Major Software Redesign for Ontario Hydro's Energy Management System HAE CHOON CHUNG	267
The Pacific Gas & Electric Company Energy Management System Overview - Unique Features D.L. BECKER, R.H. HARSHBERGER, J.C. RUSSELL, D. LEGGETT, S. MOKHTARI, R. FROWD, S. RAJAGOPAL, A.G. HOFFMAN	273
The SCADA/EMS System of the Itaipu Hydroelectric Powerplant A. COHEN, F. KEMPER, T. DY LIACCO, D. CACERES	279
Implementation of Advanced Power Application Software to KEPCO's Energy Management System YEONG-HAN KIM, HYO-SANG LEE, N. FUKUSHIMA, H. HAYASHI	285

POWER SYSTEM STABILIZERS

A Robust Self-tuning Power System Stabilizer C.M. LIM, T. HIYAMA	291
New Analysis and Tuning of Stabilizers in Multimachine Power Systems M. AKKE, B. WITTENMARK	295
Optimal PSS-Parameter Selection Algorithm with New Performance Measure J.W. JUNG, J.B. CHOO, Y.M. PARK	301
Optimal Selection of the Parameters of Power System Stabilizer HEUNG JAE LEE, Y.M. PARK, TAE WON KWON	307

Application of Fuzzy Logic Control Scheme for Stability Enhancement of a Power System T. HIYAMA, C.M. LIM	313
Transient Stabilization of Multimachine Power Systems by Variable Structure System Control HAN ZHENXIANG, TONG JIANZHONG	317

SYSTEM PROTECTION AND DIGITAL RELAYS

Digital Differential Relay for Transmission Line Protection Using a Correlation Method SUNGSOO KIM, JONGKEUN PARK, SANGHEE KANG	321
Development of a Digital PCM Current Differential Relay with 64 kbits/sec. Co-directional Interface K. SUZUKI, M. ITO, N. OHTANI, S. ODA	327
Detection of High Impedance Faults Using the Randomness of Even Harmonic Currents W.H. KWON, Y.M. PARK, G.W. LEE, M.C. YOON, M.H. YOO	333
An Algorithm for Fault-Distance Identification in Transmission Line Computer Relaying: Theory and Simulation Results M.M. SAIED, A.S. AL-FUHAID	339
A Study on the Digital Distance Relaying Scheme Using Kalman Filter MYONG-CHUL SHIN, CHUL-HWAN KIM	345
A Technique for Digital Relays to Measure Frequency and Its Rate of Change M.S. SACHDEV, JIANPING SHEN	351
Derivation of Correct Relaying Signals During Intersystem Faults for the Protection of Double-Circuit Lines J. NILGES	357

STATE ESTIMATION

Power System State Estimation Including Interconnected AC/DC Systems J.B. LEE	365
An Efficient Algorithm for Computing the Weighted Least Absolute Value Estimate in Power System Static State Estimation K.A. CLEMENTS, P.W. DAVIS, K.D. FREY	371

VOLTAGE STABILITY

A Structural Stability Analysis of Voltage Collapse on Power Systems R.A. SCHLUETER, M.W. CHANG, I. HU, R. BARRY, C. ARNDT, N. PODWOISKI, R. RAY	377
---	-----

Possibility of Jump Phenomena from Operable Load Flow Solution to Nonoperable Solution by the Impact of Switching-in of Shunt Capacitor Banks	383
Y. TAMURA, Y. TAYAMA, K. SAKAMOTO, Y. NAKANISHI, S. YOKOKAWA	
Sensitivity Analysis of Transient Security of Power Systems with Respect to Reactive Aspects	389
Y. XUE	
Security Based Economic Operation of Electric Power System	395
K.Y. LEE, Y.T. CHA, B.H. LEE, JUNG-HOON KIM	

ELECTRICAL MACHINES AND EQUIPMENT

Maximum Likelihood Estimation of High Frequency Distributed Transformer Parameters	401
A. KEYHANI, H. TSAI, A. ABUR	
Theoretical and Experimental Investigations on Circuit Breaker Transient Recovery Voltages	407
M.M. SAIED, E.A. OUFU, E.E. EL-ATTAR	
The Computer Analysis of Switching Transients Involving Arc Model	411
K.S. KIM, K.J. CORNICK	
A Study on Harmonic Elimination Method of PWM Inverter Fed Induction Motor System Using Walsh Series	417
M.H. PARK, D.S. AHN, C.Y. WON, H.K. LEE, M.K. LEE, T.H. KIM	
Optimal PWM Methods for Active Power Filters	425
IN-GYU PARK, JONG-KEUN PARK	

CONTROL CENTER MAN-MACHINE INTERFACE

A Design Tool for Distributed Man-Machine Interface of Real-Time Power Systems and Power Plant Simulators	431
S.F. DAVANZATI, E. GAGLIOTI, F. GIORNELLI, P. GRISI, R. GAVIRANGAPPA, KANYAKUMARI, MURALIKRISHNA, MURTY, MEERA, NAGAMANA, S. PARAMESWERAN	
Rule-based Approach for an Automatic Design of Substation Diagrams from a GDL-network Description	437
D. RUMPEL, J. SCHNEPPENDAHL	

DISTRIBUTION SYSTEM CONTROL

New Reconfiguration Algorithm for Distribution System - Priority Constrained Emergency Service Restoration	443
K. AOKI, K. NARA, T. SATOH	
An Integrated Network Information and SCADA System for the Control of Public Distribution Networks	449
J. PARTANEN, P. JUUTI, E. LAKERVI, J.H. ETULA	

LOAD FORECASTING AND MAINTENANCE SCHEDULING

Short-term Feeder Load Forecasting: An Expert System using Fuzzy Logic 455
G. LAMBERT TORRES, B. VALIQUETTE, D. MUKHEDKAR

An Expert System for Short Term Load Forecasting by Fuzzy Decision 461
YOUNG-IL PARK, JONG-KEUN PARK

TRANSMISSION EXPANSION PLANNING

A Sensitivity Algorithm for the Long-term Transmission Planning Formulated with Two-step Optimization Procedure 467
J.R. SHIN, Y.M. PARK, S.D. HONG

ACTOR: A New Tool to Evaluate the Annual Economic Savings Provided by a Reinforcement of a Subtransmission Network 473
J.G. VALENTIN

EXPERT SYSTEM APPLICATIONS

Network Restoration Expert System 479
G. KROST, D. RUMPEL

An Expert System for the Electric Power Distribution System Design 483
H. KIM, Y. KO, S. SHON

An Expert System Used in Power System Protection 489
L.L. LAI

PROSET: An Expert System for Protective Relay Setting 495
S.J. LEE, S.H. YOON, M.C. YOON, J.K. JANG

VOLTAGE REGULATION AND CONTROL

A Study on the Optimal Operation Method of Voltage Regulator at Distribution Substation 501
H. KIM, D. RHO, J. KIM

The 77kV 40MVA Multi-function SVC (Static Var Compensator) Installed in Substations 507
T. HASEGAWA, H. TAKESUE, D. KUBO, M. HAKODA, O. KONDO, H. YAMAMURA

Optimal Design of an Automatic Voltage Regulator for Static Var Systems 513
K.Y. LEE, A.B. EDDRIEF

SYSTEM OPERATOR TRAINING

Operator Training Using Planned Incidents in the Power System 519
S. MUCKE, W. BERGSTROM, H.-H. CLOD-SVENSSON

Power System Simulator for Realistic Dispatcher Training 523
K. HEUCK, A. HUBER, E. REUTER

POWER SYSTEMS SIMULATORS

Development of High Precision Power System Simulator Y. NORO, J. ARAI, M. OTSUKI, M. UDO, N. ITOH	529
Fast Dynamic Simulation of Power Systems Using Multiple Microcomputers M. EHSAN, B.J. CORY, M.J. SHORT	535
Author Index	541
Keyword Index	543