

POWER CAPACITOR

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Doc Type: IEEE Transactions on Power Systems
A Heuristic Constructive Algorithm for Capacitor Placement on Distribution Systems

Authors I.C. da Sylva, S. Carneiro, E.J. de Oliveira, J. de Souza Costa, J.L. R. Pereira and P.A. N. Garcia

IEEE Transactions on Power Systems
Vol. 23, no 4, November 08, page 1619

Language: English

Abstract: This paper presents a heuristic constructive algorithm (HCA) for optimal capacitor placement on distribution systems..

Doc Type: IEEE Transactions on Power Delivery
On Tracking the Source Location of Voltage Sag and Utility Shunt Capacitor Switching Transients

Authors: G.W Chang, J.P Chao, H.M. Huang, C.I. Chen, and S.Y. Chu

Ref: IEEE Transactions on Power Delivery
Vol. 23, no 4, October 2008, page 2124

Language: English

Abstract: This paper presents a new procedure to track the disturbances source location of voltage sags and shunt capacitor switching transients in a power system based on branch current measurements.

Doc Type: IEEE Transactions on Industry applications
Capacitor application Issues

Authors Blooming T M, Carnovale D J.

Ref: IEEE Transactions on Industry Application
Vol. 44, no 4, July-Aug 08, page 1013

Language: English

Abstract: This paper does not get into rigorous detail but rather discusses these issues with the goal of making the reader aware of many of the traps one can fall into when applying capacitors. The application issues are addressed based on the authors' experiences working in various capacities thus seeing these problems from many different angles.

Doc Type: IEEE Transactions on Industry applications
Protection of Tuned Capacitor Banks

Authors Nepveux, F.J.
Ref: IEEE Transactions on Industry Application

Vol. 44, no 4, July-Aug 08, page 973

Language: English

Abstract: The purpose of this paper is to describe several different methods of protection of tuned capacitor banks and how the relay protection

settings for each are determined. Problems with the different schemes are described, and a new protective scheme is proposed.

Doc Type: IEEE Transactions on Power Delivery
On two Fundamental Signatures for determining the Relative Location of Switched Capacitor Banks
Authors: Kyeon Hur, Surya Santoso
Ref: IEEE Transactions on Power Delivery
Vol. 23, no 2, April 2008, page 1105
Language: English
Abstract: This paper describes two fundamental signatures of shunt capacitor bank switching transient phenomena from which one can accurately determine the relative location of an energized capacitor bank whether it is upstream or downstream from the monitoring location.

Doc Type: IEEE Transactions on Power Systems
Control of a ULTC Considering the dispatch Schedule of Capacitors in a distribution System
Authors: J.Y.Park, S. R. Nam and J.K. Park
Ref: IEEE Transactions on Power Systems
Vol. 22, no 2, May 07, page 755
Language: English
Abstract: This paper proposes a coordinated control method for an under-load tap Changer (ULTC) with switching capacitors in distribution systems to reduce the operation numbers of both devices.

Doc Type: IEEE Transactions on Power Delivery
Accurate Calculation of magnetic Field Intensity Due to Overhead Power Lines with or without Mitigation Loops with or without Capacitor compensation
Authors: J. A. Brandao Faria and M.E. Almeida
Ref: IEEE Transactions on Power Delivery
Vol. 22, no 2, April 2007, page 951
Language: English
Abstract: An accurate method for evaluation of 50 Hz magnetic fields produced by overhead power lines is presented. Results presented include a discussion on the effects of mitigation loops with or without capacitor compensation.

Doc Type: IEEE Transactions on Power Delivery
Static Shunt and Series Compensations of an SMIB System Using Flying Capacitor Multilevel Inverter
Authors: Anshuman Shukla, Arindam Ghosh, Avinash Joshi

- Ref: IEEE Transactions on Power Delivery
Vol. 20, no 4, October 2005, page 2613
- Language: English
- Abstract: The flying capacitor multilevel inverter (FCMLI) is a multiple voltage level inverter topology intended for high-power and high-voltage operations at low distortion. A method for controlling the FCMLI is proposed which ensures that the flying capacitor voltages remain nearly constant using the preferential charging and discharging of these capacitors.
- Doc Type: IEEE Transactions on Power Delivery
Capacitor Voltage Balancing in Multi-Level Voltage Reinjection (MLVR) Converters
- Authors: Y.H. Liu J. Arrillaga, N. R. Watson
- Ref: IEEE Transactions on Power Delivery
Vol. 20, no 2, April 2005, page 1728
- Language: English
- Abstract: The operation conditions that lead to capacitor voltage unbalance are analyzed and the use of adaptive adjustment of the clamping switches conducting periods is investigated.
- Doc Type: IEEE Transactions on Power Delivery
Capacitor Switching transients: Analysis and Proposed Technique for Identifying Capacitor Size and Location
- Author: Mohamed. M. Saied
- Ref: IEEE Transactions on Power Delivery
Vol. 19, no 2, April 2004, page 759
- Language: English
- Abstract: This paper deals with the analysis of transients initiated by switching of shunt capacitors in power networks. These transients will propagate through the network along the transmission elements and will, accordingly, be felt at other locations far from the capacitors, such as load terminals.
- Doc Type: IEEE Transactions on Power Systems
Microgenetic Algorithms and Fuzzy logic applied to the Optimal Placement of Capacitor Banks in Distribution Networks
- Authors: Benemar Alencar de Souza, Helton do Nascimento Alves, Helvio Alves Ferreira
- Ref: IEEE Transactions on Power Systems
Vol. 19, no 2, May 04, page 942
- Language: English
- Abstract: A Microgenetic Algorithms (MGA) in conjunction with a fuzzy logic (FL) is proposed for solving the capacitor placement problem. The objective

function includes economic savings obtained by energy loss reduction in contrast with acquisition and installation costs of fixed and switched capacitors.

Doc Type: IEEE Transactions on Power Delivery
Capacitor Placement for Conservative Voltage Reduction on Distribution Feeders

Authors: Borka Milosevic, Miroslav Begovic
Ref: IEEE Transactions on Power Delivery
Vol. 19, no 3, July 2004, page 1360

Language: English

Abstract: This paper proposes a strategy for placing capacitors at multiple locations on a distribution feeder to allow : 1) deeper levels of substation voltage reduction for peak load reduction; 2) power factor correction; and 3) power loss reduction.

Doc Type: IEEE Transactions on Power Delivery
Power factor and your electrical utility bill in Egypt

Authors: M. M. Abdel Aziz, E. E. Abou El-Zahab, and A. F. Zobaa
Ref: IEEE Transactions on Power Delivery
Vol. 18, no 4, October 2003, page 1567

Language: English

Abstract: Beside being a good neighbor and not causing harmonic voltage for others that are connected to your electrical distribution circuit, complying with the legal requirements of IEEE standards 519, and maintaining safe and economical operating environments for electrical equipment within your physical load, there is another very good reason to maintain a good power factor: saving money on your electrical utility bill. This letter discusses this topic.

Doc Type: IEEE Transactions on Power Delivery
Capacitive compensation at nonsinusoidal buses based on IEEE Std 18-1992

Authors: A. F. Zobaa
Ref: IEEE Transactions on Power Delivery
Vol. 18, no 4, October 2003, page 1562

Language: English

Abstract: This letter presents a proposed method for finding the optimum fixed compensating capacitor to minimize the voltage harmonic distortion at a load bus while holding the power factor at a desired value and constraining the nameplate kvar of the compensating capacitor, its rated voltage rms, and its rated current rms as constraints according to IEEE Std 18-1992. Also the values of the compensating capacitor, which would

create resonant conditions, would be omitted from the solution. Finally, the contribution of the newly developed method is demonstrated in an example taken from previous publications.

- Doc Type: IEEE Transactions on Power Delivery
Control Schemes for Equalization of Capacitor Voltages in Neutral Clamped Shunt Compensator
- Authors: M. K. Mishra, A. Joshi and A. Ghosh
- Ref: IEEE Transactions on Power Delivery
Vol. 18, no 2, April 2003, page 538
- Language: English
- Abstract: In this paper, a two-quadrant chopper has been used to regulate the capacitor voltages in a two-capacitor compensator structure. Two different control strategies for the two-quadrant chopper to equalize the voltage of the capacitors have been proposed.
- Doc Type: Electric Power Systems Research
Sizing of capacitors to optimize the power factor at non-sinusoidal frequencies
- Authors: M. M. Abdel Aziz, E. E. Abou El-Zahab, A. M. Ibrahim, and A. F. Zobaa
- Ref: Electric Power Systems Research
Vol. 64, no 1, January 2003, page 81
- Language: English
- Abstract: Optimization criteria are presented which allows proper calculation of optimal power factor. Optimization minimizes the line loss, maximizes the power factor and maximizes the efficiency taking into consideration the skin effect. The performance of the obtained capacitor is discussed by means of numerical example.
- Doc Type: IEEE Power Engineering Review
On the economic selection of capacitive compensator sizes in nonsinusoidal conditions
- Authors: M. M. Abdel Aziz, E. E. Abou El-Zahab, A. M. Ibrahim, and A. F. Zobaa
- Ref: IEEE Power Engineering Review
Vol. 22, no 10, October 2002, page 47
- Language: English
- Abstract: The selection of the optimal capacitor is a multi-objective optimization problem. One of known approaches for solving a multi-objective optimization problem is to transform it into a single objective problem. In this paper it is proposed to use the power factor and the efficiency as constraints. This is because of power factor in distributions systems may be allowed within certain limits such as 0.85 and 1.0, and similarly for the efficiency.

Doc Type: Proceedings of the 2002 Large engineering Systems Conference on Power Engineering

State of the art in optimal capacitor allocation for reactive power compensation in distribution feeders

Authors: S.F. Mekhamer et. al.

Ref: Proceedings of the 2002 Large engineering Systems Conference on Power Engineering

July 2002, page 61

Language: English

Abstract: The application of capacitors in electric power systems is intended for the control of power flow, improvement of stability, voltage profile management, power factor correction, and loss minimization. This paper presents a review of different solution methods found in the literature and is intended as a guide for those interested in the problem or intending to do additional research in the area. The assumptions made and brief descriptions of the solution methods are presented.

Doc Type: IEEE Transactions on Power Delivery

Unbalance Protection of Fuseless, Split-Wye, Grounded, Shunt Capacitor Banks

Authors: R.Horton, T.Warren, K.Fender, S.Harry, and C.A. Gross

Ref: IEEE Transactions on Power Delivery

Vol. 17, no 3, July 2002, page 698

Language: English

Abstract: This paper presents a novel method of calculating the unbalance current produced by fuseless capacitor units failures as well as some general background information regarding fuseless split-wye grounded capacitor bank technology and unbalanced protection.

Doc Type: IEEE Power Engineering Review

Economic AC Capacitors

Authors: William B. Duff Jr.

Ref: IEEE Power Engineering Review

Vol. 22, no 1, January 2002, page 4

Language: English

Abstract: Properly deployed ac capacitors enhance operation of the grid by tuning system parameters for maximum power transfer efficiency, increasing source real power deliverable to loads.

Doc Type: IEEE Transactions on Power Delivery

World's First Commercial Bridge Capacitor Bank Installation on the American Electric Power System

Authors: R. Andrei, M. Ahmed, H.K. Tumageanian and J.C. Smith

Ref: IEEE Transaction on Power Delivery
Vol. 16, no 2, April 2001, page 342

Language: English

Abstract: The paper presents some of the engineering aspects of the first commercial installation of a bridge capacitor bank on the American Electric Power System.

Doc Type: IEEE, ESMO Montréal conference

Capacitor Measurement in the substation Environment : a New Approach

Authors: R. Sévigny, S. Ménard, C. Rajotte and M. McVey

Ref: ESMO Conference
October 2000,

Language: English

Abstract: This paper will assess the implication of the presence of the new technologies in the substation as well as their impacts on the capacitor-measuring device.

Doc Type: IEEE Transactions on Power Systems

Optimal Capacitor Placement Using Deterministic and Genetic Algorithms

Authors: M. Delfanti, G.P. Granelli, P. Marannino and M. Montagna

Ref: IEEE Transaction on Power Systems
Vol. 15, no 3, August 2000, page 1041

Language: English

Abstract: The paper presents a procedure for solving the capacitor placement problem. The objective is to determine the minimum investment required to satisfy suitable reactive constraints.

Doc Type: IEEE Transactions on Power Delivery

Optimal Capacitor Allocation in Distribution Systems Using a Genetic Algorithm and a Fast Energy Loss Computation Technique

Authors: G. Levitin, A. Kalyuzhny, A. Shenkman and M. Chertkov

Ref: IEEE Transaction on Power Delivery
Vol. 15, no 2, April 2000, page 623

Language: English

Abstract: The paper presents a new approach to shunt capacitor placement in distribution systems having customers with different load patterns. The allocation of capacitors is considered in a system comprising a network of

feeders fed from an upstream equivalent transmission system through a substation transformer.

- Doc Type: IEEE Transactions on Power Delivery
A Graph Search algorithm for Optimal Placement of fixed and Switched Capacitors on Radial distribution systems.
- Authors: J.C. Carlisle, A.A. El-Keib
- Ref: IEEE Transaction on Power Delivery
Vol. 15, no 1, January 2000, page 423
- Language: English
- Abstract: The paper presents a practical solution technique to the capacitor placement problem that is easy to implement. The proposed approach uses a graph search algorithm.
- Doc Type: IEEE Transactions on Power Delivery
Capacitor Allocation by Approximate Reasoning: Fuzzy Capacitor Placement
- Authors: N. Ng, M.A. Salama, A.Y. Chikhani
- Ref: IEEE Transaction on Power Delivery
Vol. 15, no 1, January 2000, page 393
- Language: English
- Abstract: The paper presents a novel approach using approximate reasoning to determine suitable candidate nodes in a distribution system for capacitor placement.
- Doc Type: IEEE Transactions on Power Delivery
Classification of Capacitor Allocation Techniques
- Authors: N. Ng, M.A. Salama, A.Y. Chikhani
- Ref: IEEE Transaction on Power Delivery
Vol. 15, no 1, January 2000, page 387
- Language: English
- Abstract: The paper describes the evolution of the research and provides an evolution of the practicality and accuracy of the capacitor placement algorithms in the literature.
- Doc Type: IEEE Transactions on Dielectrics and Electrical Insulation
The effect of Non-sinusoidal Voltage on Intrinsic Aging of Cable and Capacitor Insulating materials
- Authors: G.C. Montanari and D. Fabiani
- Ref: IEEE Transaction on Dielectrics and Electrical Insulation
Vol. 6, no 6, December 1999, page 798
- Language: English

Abstract: The paper investigates the effect of non-sinusoidal voltage, i.e. voltage affected by the presence of harmonics, on intrinsic aging of cable and capacitor insulating materials, i.e. cross-linked polyethylene (XLPE) and polypropylene (PP).

Doc Type: IEEE Transactions on Power Delivery

Identification of Capacitor Position in a Radial System

Authors: D. Sochuliakova, D. Niebur, C.O. Nwankpa, R. Fischi, D. Richardson

Ref: IEEE Transaction on Power Delivery
Vol. 14, no 4, October 1999, page 1368

Language: English

Abstract: The paper addresses the identification of switched capacitor position such that on-line or post-fault measures can be taken.

Doc Type: Transmission & Distribution World

Capacitor Control Gives Voltage a Lift

Authors: R. Trammel and Kent D. McCarthy

Ref: Idaho Power Co.
August 1999, page 64

Language: English

Abstract: Efficient use of small groups of capacitors provides significant benefits

Doc Type: IEEE Transactions on Power Delivery

**A Novel Fuseless Capacitor Bank Design Using Conventional
single-Bushing Capacitors**

Authors: R.G. Andrei,

Ref: IEEE Transaction on Power Delivery
Vol. 14, no 3, July 1999, page 1124

Language: English

Abstract: A novel fuseless capacitor bank design using conventional single-bushing capacitors is presented. The design can be used for shunt and series capacitor bank installations

Doc Type: American Power Conference

**Development of the EMTP Model of IPL Transmission System and
Pre-specification Studies for Design and Installation of a 138 KV
Capacitor Bank**

Authors: M.J. Kempler, R.M. Arness, N.Rostamkolai and S.L. Clouse

Ref: Indianapolis Power & Light Co.
1999

Language: English

Abstract: Studies conducted by IPL indicated the need for the addition of a capacitor bank to the 138kV transmission system. An overvoltage study was conducted with EMTP to determine the size, connection configuration, and best location for the capacitor bank.

Doc Type: American Power Conference
Application of Reclosing Schemes in the Presence of Capacitor Bank Ringdown

Authors: L.M. Ganatra, P.G. Mysore, K.K. Mustaphi, A. Mulawarman, B. Mork and G. Gopakumar

Ref: 1999

Language: English

Abstract: Installation of shunt capacitor banks on transmission lines for local voltage support raises concerns about performance capabilities of existing line breakers.

Title: **Capacitor Commutated Converter Circuit Configurations for Dc Transmission**

Authors: K.Sadek, M. Pereira, D.P. Brandt, A.M. Gole & A. Daneshpooy

Ref: IEEE Transaction on Power Delivery
Vol. 13, no 4, October 1998, page 1257

Language: English

Abstract: Two non-conventional HV dc converter arrangements are compared. These include the Capacitor Commutated Converter (CCC) in which series capacitors are included between the converter transformer and the valves, and the Controlled Series Capacitor Converter (CSCC), based on more conventional topology, in which series capacitors are inserted between the ac filter bus and the ac network.

Title: **Techniques for Diagnosing Deterioration of oil-Impregnated Paper-Film Power Capacitors**

Authors: S. Okabe, M. Koto, T. Muraoka, K. Suganuma and K. Tkahashi

Ref: IEEE Transactions on Power Delivery
VOL. 12, no 4, October 1997, p. 1751

Language: English

Abstract: Study of techniques for diagnosing deterioration consisting of caution level and danger level, from actual stress in the field. A trial calculation was made for the number of years and months it takes for a capacitor to reach the caution level, from an investigation of capacitors in service for years.

- Doc Type: IEEE Transactions on Power Systems
Title: **Capacitor Placement, Replacement and control in Large-Scale distribution Systems by a GA-Based Two-Stage Algorithm**
Authors: Karen Nan Miu, Hsiao-Dong Chiang & Gary Darling
Ref: IEEE Transactions on Power Systems
VOL. 12, no 3, August 1997, p. 1160
Language: English
- Abstract: This paper presents a two-stage algorithm tailored for capacitor placement, replacement and control of general, large-scale, unbalanced distribution systems.
- Doc Type: IEEE Transactions on Power Delivery
Title: **Capacitive divider substation**
Authors: L. Bolduc, B. Bouchard & G. Beaulieu
Ref: IEEE Transactions on Power Delivery
VOL. 12, no 3, July 1997, p. 1202
Language: English
- Abstract: This paper presents the underlying theory and analyzes the impact of the SCC on a power network system.
- Doc Type: IEEE Transactions on Power Delivery
Title: **Capacitor Placement and Real Time Control in Large Scale unbalanced Distribution Systems: Numerical Studies**
Authors: J.C. Wang, H.D. Chiang, K.N. Miu and G. Darling
Ref: IEEE Transactions on Power Delivery
VOL. 12, no 2, April 1997, p. 953
Language: English
- Abstract: A novel solution algorithm for capacitor placement and real time control in real large-scale unbalanced distribution systems is evaluated.
- Doc Type: IEEE Transactions on Power Delivery
Title: **Capacitor Placement and Real Time Control in Large Scale unbalanced Distribution Systems: Loss Reduction Formula, Problem Formulation, solution Methodology and Mathematical Justification**
Authors: J.C. Wang, H.D. Chiang, K.N. Miu and G. Darling
Ref: IEEE Transactions on Power Delivery
VOL. 12, no 2, April 1997, p. 953
Language: English
- Abstract: A comprehensive study of capacitor placements and real-time control in general unbalanced distribution systems is undertaken
- Doc Type: IEEE Transactions on Power Systems

- Title: **Application of Double-Layer Capacitor Technology to Static Condensers for Distribution System Voltage Control**
- Authors: S.M. Halpin, R.L. Spyker, R.M. Nelms, R.F. Burch
- Ref: IEEE Transactions on Power Systems
VOL. 11, no 4, November 1996, p. 1899
- Language: English
- Abstract: The use of double-layer capacitors in static condensers is examined in this paper. These capacitors are characterized by high values of capacitance and equivalent parallel resistance and low values of equivalent series resistance.
- Doc Type: IEEE Transactions on Power Systems
- Title: **Solving the Capacitor Placement Problem in a Radial Distribution System Using Tabu Search Approach**
- Authors: Yann-Chang Huang, Hong-Tzer Yang, Ching-Lien Huang
- Ref: IEEE Transactions on Power Systems
VOL. 11, no 4, November 1996, p. 1868
- Language: English
- Abstract: In this paper, a sensitivity analysis method is used to select the candidate installation locations of the capacitors to reduce the search space of this problem a priori.
- Doc Type: IEEE Transactions on Power Delivery
- Title: **BRIDGE CAPACITOR BANK DESIGN AND OPERATION**
- Authors: R.G. Andrei, R.R. Kaushik, R.W. Reinaker
- Ref: IEEE Transactions on Power Delivery
VOL. 11, no 1, January 1996, p. 227
- Language: English
- Abstract: This paper discusses design and operation aspects related to the installation of a bridge capacitor bank in a substation.
- Doc Type: IEEE Transactions on Dielectrics and Electrical Insulation
- Title: **Accelerated ac Degradation of Impregnated PP films**
- Authors: A. Gadoum, B. Gosse and J-P Gosse
- Ref: IEEE Transaction on Dielectrics and Electrical Insulation
Vol. 2, no 6, December 1995, page 1075
- Language: English
- Abstract: The influence of the liquid, its impurities and additives on the ac degradation of impregnated polypropylene (PP) films has been investigated.
- Doc Type: Electrical World

Title: **Optimize Placement of in-plant Power-Factor Correction Capacitors**
Authors: Barry Kennedy from Bonneville Power Administration
Ref: Electrical World, Oct. 1995
Language: English

Abstract: Bonneville Power Administration (BPA) recently developed a guidebook and software to help its industrial customers in the Pacific Northwest to improve power factor in their plants and save money on their electric bills.

Doc Type: IEEE 95 Summer Meeting presentation (Portland, OR)
Title: **CAPS: Improving Power System Stability Using the Time-Overvoltage Capability of large Shunt Capacitor Banks.**
Authors: Carson W. Taylor, Allen L. Van Leuven from Bonneville Power Administration
Ref: IEEE 95 SM ??? PWRS
Language: English

Abstract: A new special stability control termed CAPS improves power system stability by exploiting the time-overvoltage capability of large shunt capacitor banks. During low voltage emergencies, several series groups of wye-connected capacitor banks are shorted to increase reactive power output. We describe successful commissioning tests pm a 241.5 kV, 168 MVar capacitor bank.

Doc Type: IEEE 95 Winter Meeting presentation, (New-York, NY)
Title: **Volt/VAr Control Algorithm for Modern Distribution Management System**
Authors: I. Roytelman, B.K. Wee, R.L. Lugtu from Siemens Energy & Automation, Inc.
Ref: IEEE 95 WM 136-2 PWRS
Language: English

Abstract: In this paper, a centralized Volt/Var Control (VVC) algorithm for Distribution Management System is presented. The algorithm is based on the oriented discrete coordinate descent method and takes into account all the optimization objectives of interest to distribution system analysis: minimum power loss, power demand or the number of control steps to keep the system within constraints.

Doc Type: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
Title: **Characteristics and Measurement of Capacitor Switching at Medium Voltage Distribution Level**
Authors: Charles E. McCoy and Bart L. Floryancic
Ref: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
VOL. 30, no 6, Nov/Dec 1994, p. 1480
Language: English

Abstract: This paper presents the main/basic characteristics and impact that capacitors and capacitor switching cause on medium voltage plant distribution systems. Analytical information and the results of actual measurement are included. The measurement equipment used also provided harmonic spectrum analysis which gave insight into the basic system characteristics.

Doc Type: Working Group 13.04
Title: **Capacitive Current Switching - State of the Art**
Authors: WG 13.04
Ref: Électra No. 155 Aug 1994, p 33
Language: English

Abstract: In the present paper a summary is made of the various capacitive currentswitching phenomena, together with test circuits and test procedures in use today. In addition, a brief description is given of the relevant properties of different types of circuit-breakers and switches used for capacitive current switching.

Doc Type: IEEE 94 Summer Meeting presentation (San Francisco, CA)
Title: **Reactive Management a Key to Survival in the 1990s**
Authors: P. Nedwick, A.F. Mistr,Jr, E.B. Croasdale from Virginia Power
Ref: IEEE 94 SM 551-2 PWRS
Language: English

Abstract: This paper will describe a method to develop a Reactive Management Program. Also included is a description of a system using this philosophy that performed efficiently during an extreme operating condition in June of 1989.

Doc Type: IEEE 94 Summer Meeting presentation (San Francisco, CA)
Title: **Optimal Shunt Compensators at Nonsinusoidal Busbars**
Authors: I.M. El-Amin, S.O. Duffuaa, A.U. Bawah from King Fahd University of Petroleum and Minerals
Ref: IEEE 94 SM 521-5 PWRS
Language: English

Abstract: A model for determining an optimal shunt capacitor value at nonsinusoidal busbars combining three basic criteria - maximizing the power factor, minimizing the line losses, and maximizing the transmission

efficiency is developed. The choice of the capacitor value is constrained by the values that may cause resonance.

Doc Type: Journal Paper
Title: **Vibration and audible noise of capacitors subjected to nonsinusoidal waveforms**
Authors: Cox, M.D.; Guan, H.H.
Affiliation: Dept. of Electr. Eng., Louisiana Tech. Univ., Ruston, LA, USA
Journal: IEEE Transactions on Power Delivery
Vol: 9 Iss: 2 p. 856-62
Date: April 1994
Country of Publication: USA
ISSN: 0885-8977 CODEN: ITPDE5
CCC: 0885-8977/94/\$04.00
Language: English

Abstract: Vibration and audible noise generated by power capacitors subjected to nonsinusoidal waveforms are discussed. A study of the relation between the vibration (audible noise generated) and the capacitor current (and voltage) is presented. Capacitor data obtained in the laboratory and in a distribution substation are compared. This investigation confirms that a bank of power capacitors can generate significant noise if the capacitor current contains high frequency harmonics. (5 Refs.)

Doc Type: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
Title: **Harmonics and Transient Overvoltages Due to Capacitor Switching**
Authors: Adly A. Girgis, Christopher M. Fallon, Jay C. Rubino, and Ray C. Catoe
Ref: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
VOL. 29, no 6, Nov/Dec 1993, p. 1184

Language: English
Abstract: This paper present a study of the steady state and transient effects of power factor correction capacitors on the utility and on the customer. In the presence of harmonic producing loads, capacitors used for power factor correction can cause parallel or series resonance problems which tend to increase the total harmonic distortion (THD) of the voltage and current waveforms. The cases studied in this paper consider the addition of a power factor correction capacitor, in the presence of downstream harmonic loads and at the harmonic load site.

Doc Type: Journal Paper
Title: **The supercapacitor**
Authors: Clerici, G.
Journal: Tecnologie Elettriche

Vol: 20 Iss: 6 p. 64-5, 67
Date: July-Aug. 1993
Country of Publication: Italy
ISSN: 0390-6698 CODEN: TEELDN

Language: Italian

Abstract: The article describes the technology of the 'supercapacitor' which makes use of the molecular 'double layer' which forms at the electrode/electrolyte interface of an electrochemical cell. Current developments of this device use porous active carbon electrodes and a sulphuric acid or solid polymer electrolyte. The specific capacitance of the layer is of the order of 20 to 40 $\mu\text{F}/\text{cm}^2$, but because of the enormous surface area of the porous carbon, which is of the order of 1000 m^2/g , capacitances of the order of hundreds of F/g can be obtained, albeit at very low operating voltages of the order of 2 or 3V at most. The capacitance of the earth considered as a conducting sphere is 708 mF. Matsushita catalogue a unit of 20 F and have in preproduction units of 100, 470, and 1500 F. Their characteristics and applications are described. (0 Refs.)

Doc Type: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
Title: **Overcurrent Protection of Capacitors Applied on Industrial Distribution Systems**

Authors: S.R. Mendis, M.T. Bishop, J.C. McCall, W.M. Hurst
Ref: IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS
VOL. 29, no 3, May/June 1993, p. 541

Language: English

Abstract: This paper reviews different considerations in the selection of capacitor fuse applications and the philosophies behind them. Individual and group fusing are discussed. Continuous current, transient current, fault current, tank rupture curve coordination, voltage on good capacitors during a fault, energy discharged into a failed unit, outrush current, and coordination with unbalance detection schemes are topics covered. Examples of actual applications of capacitors in industrial distribution systems are presented throughout the paper.

Doc Type: IEEE 92 Summer Meeting presentation (Seattle, WA)
Title: **New algorithm for protection of capacitor banks exposed to harmonic overvoltages**
Authors: Gabriel Benmouyal, Hubert Bilodeau, Simon Chano, Gilbert Sybille from Hydro-Québec
Ref: IEEE 92 SM 375-6 PWRD
Language: English

Abstract: This paper presents an harmonic simulation case study, the purpose of which is to evaluate the performance of capacitor overvoltage relays in static var compensator (SVC) installation. The paper introduces the new concept of a computer based digital relay, designed to reduce the overprotection trend found in conventional relays. The major concern is to properly evaluate the time stresses applied on the capacitor according to NEMA (ANSI/IEEE) standard.

Doc Type: IEEE 92 Summer Meeting presentation (Seattle, WA)
Title: **A Simplified Network Approach to the VAR Control Problem for Radial Distribution Systems**
Authors: M.M.A. Salama from University of Waterloo, Ontario Canada
A.Y. Chikhani from Royal Military College, Ontario Canada
Ref: IEEE 92 SM 506-6 PWRD
Language: English

Abstract: A simplified network approach to the var control problem in a distribution system with lateral branches is presented in this paper. According to this method, the capacitors are assumed to be located optimally at the feeder branches. The optimal compensation levels (capacitor sizes) are represented by dependent current sources located at the branch connected buses.

Doc Type: Conference Paper
Title: **Molecular modeling of polymers for high energy storage capacitor applications**
Authors: Bendler, J.T.; Takekoshi, T.
Affiliation: General Electric Co., Schenectady, NY, USA
Conf. Title: 1992 IEEE 35th International Power Sources Symposium
(Cat. No.92CH3109-6)
p. 373-6
Publisher: IEEE

New York, NY, USA
Date: 1992 405 pp.
Country of Publication: USA
ISBN: 0 7803 0552 3
CCC: 0 7803 0552 3/92/\$03.00

Language: English

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Abstract: Polymer-based capacitors with higher voltage and higher energy density limits than currently available are possible if dielectric constants can be increased without compromising thermal and mechanical properties or the ability to clear defect sites. A molecular modeling approach is described which has the goal of designing a modified glassy (poly)etherimide polymer with a bulk dielectric constant several times larger than the parent resin. Segment-level dipole moments are predicted using *ab initio* and semiempirical quantum mechanical self-consistent field methods, and torsional-rotational mobility is estimated using force-field calculations to evaluate intramolecular and intermolecular energy barriers. Finally, bulk dielectric constants are calculated from the Onsager-Kirkwood equation for amorphous systems. (7 Refs.)