current densities due to current in the ground electrode of a HVDC system in any point of nonhomogeneous soils and air media, taking into account the complexities of the problems involved. Results of these variables are shown for the case of a toroidal ground electrode of a HVDC system installed in homogenous and nonhomogenous soils.

Keywords Electric field, ground electrode, heterogeneous soil.

Preprint Order Number: PE-645PRD (08-2002)

Discussion Deadline: January 2003

Prediction Model for Radiated Magnetic Field at Industrial Frequency due to Randomly Placed Conductors Pairs

Orlandi, A.

Author Affiliations: University of L'Aquila, Italy.

Abstract: The statistical analysis of the magnetic flux density due to sinusoidal steady-state 50 Hz (or 60 Hz) currents in conductor pair randomly placed inside a conduit is carried out by means of a suitable developed computation model. From the statistics of the field, an equivalent deterministic model is derived. This model allows one to estimate the magnetic flux density levels without knowing the exact position of the conductors. The results are compared with those measured in two laboratory experimental setups.

Keywords: Magnetic fields, statistical model.

Preprint Order Number: PE-786PRD (08-2002)

Discussion Deadline: January 2003

Stochastic Evaluation of Voltage Sags in Series Capacitor Compensated Radial Distribution Systems

Faried, S.O.; Aboreshaid, S.

Author Affiliations: University of Saskatchewan, Canada.

Abstract: Voltage sags, also known as dips, are important to industrial reliability. This paper presents a Monte Carlo based approach to evaluate the maximum voltage sag magnitudes in series capacitor compensated radial distribution systems. In this context, investigations have been conducted on a sample distribution system model taking into consideration the uncertainty of several factors associated with the practical operation of a power system. The Power System Blockset of MATLAB is used in the simulation studies.

Keywords Distribution series capacitors, voltage sags, power quality, stochastic techniques.

Preprint Order Number: PE-264PRD (08-2002)

Discussion Deadline: January 2003

Design of Step Dynamic Voltage Regulator for Power Quality Enhancement

Liu, J.W.; Choi, S.S.; Chen, S.

Author Affiliations: Nanyang Technological University, Singapore.

Abstract: The design of a step dynamic voltage regulator is considered for the purpose of restoring load voltage without incurring excessive phase angle shift. As a type of custom-power device devoid of any significant energy-storage capability, the process of voltage restoration by the regulator has to depend on the power in-feed from external supply system. As a consequence, the analysis shows that there are inherent limits imposed on the device for achieving successful voltage restoration. Pertinent expressions are derived which relate the limits to the parametric values describing the supply system and loads. When the expressions are used in conjunction with a proposed computational procedure, a method to determine suitable regulator design for the purpose of power quality enhancement is obtained.

Keywords: Power quality enhancement, step-dynamic voltage regulator, voltage magnitude and phase angle shift.

Preprint Order Number: PE-036PRD (08-2002)

Discussion Deadline: January 2003

Harmonic Domain Dynamic Transfer Function of a Nonliner Time-Periodic Network

Noda, T.; Semlyen, A.; Iravani, R.

Author Affiliations: CRIEPI, Japan; University of Toronto, Canada.

Abstract: This paper presents a new concept called harmonic domain dynamic transfer function (HDDTF), which characterizes the dynamics of a nonlinear time-periodic network as seen from a port (or multiple ports) in terms of the frequency response of harmonic perturbations superimposed on its underlying periodic steady state. It pertains to the transient behavior superimposed on the steady state. The HDDTF is a transfer-function matrix $H(s)$ relating the vectors of harmonic domain input and output endowed with s-domain properties. Because the network can contain saturable (nonlinear) elements and periodically-switching (time-periodic) power electronics components, the HDDTF may be used for the analysis of power quality problems. It may also serve for the identification of a reduced-order dynamic equivalent of a nonlinear time-periodic network to be used in time-domain transient simulations. The HDDTF is obtained by linearization about the periodic steady state of the nonlinear state equations describing a given network. Following the derivation of the HDDTF, a modal analysis to characterize the HDDTF by its diagonalization is presented. Two test systems are used to produce numerical examples.

Keywords: Dynamics, electromagnetic transient analysis, large-scale systems, nonlinear circuits, periodic functions, power electronics, power quality, power system harmonics, saturable cores, transfer functions.

Preprint Order Number: PE-086PRD (08-2002)

Discussion Deadline: January 2003

Stockbridge Type Damper Effectiveness Evaluation, Part I: Comparison Between Tests on Span and on the Shaker

Diana, G.; Cigada, A.; Belloli, M.; Vanali, M.

Author Affiliations: Politecnico di Milano, Italy.

Abstract: This paper deals with an experimental measurement campaign carried out with a modified dynamometric Stockbridge damper clamped to a laboratory test span. The aim is to get the force and the torque exerted between the cable and the damper on a span. This approach obtains the mechanical impedance of the damper under real working conditions, with the possibility to separate the contribution of the torque and of the force out of the global losses, and to compare these results with those obtained on a shaker where only the vertical motion is imposed, with no rotation. More than 100 experimental tests were executed from February 2001 to July 2001, also looking for a metrological validation of the results and for quality assessment of the collected data. Some results are shown, pointing out a comparison between the damper behavior on the span and on dynamic exciter.

Keywords: Aeolian vibration, cable damping, cable vibration, Stockbridge damper.

Preprint Order Number: PE-142PRD (08-2002)

Discussion Deadline: January 2003

Stockbridge Type Damper Effectiveness Evaluation, Part II: The Influence of the Impedance Matrix Terms on the Energy Dissipated

Diana, G.; Manenti, A.; Pirotta, C.; Zuin, A.

Author Affiliations: Politecnico di Milano, Italy; Universita degli Studi, Italy.

Abstract: This paper deals with a methodology to evaluate the 2x2 mechanical impedance matrix of a nonsymmetric Stockbridge type damper, based on damper translational tests on a shaker and on a 6 d.o.f model of the damper itself. A series of comparisons with data measured on a laboratory span are reported in order to investigate the effect of the single matrix terms on the global energy dissipation. The results of a software simulating the aeolian vibration behavior of a cable and