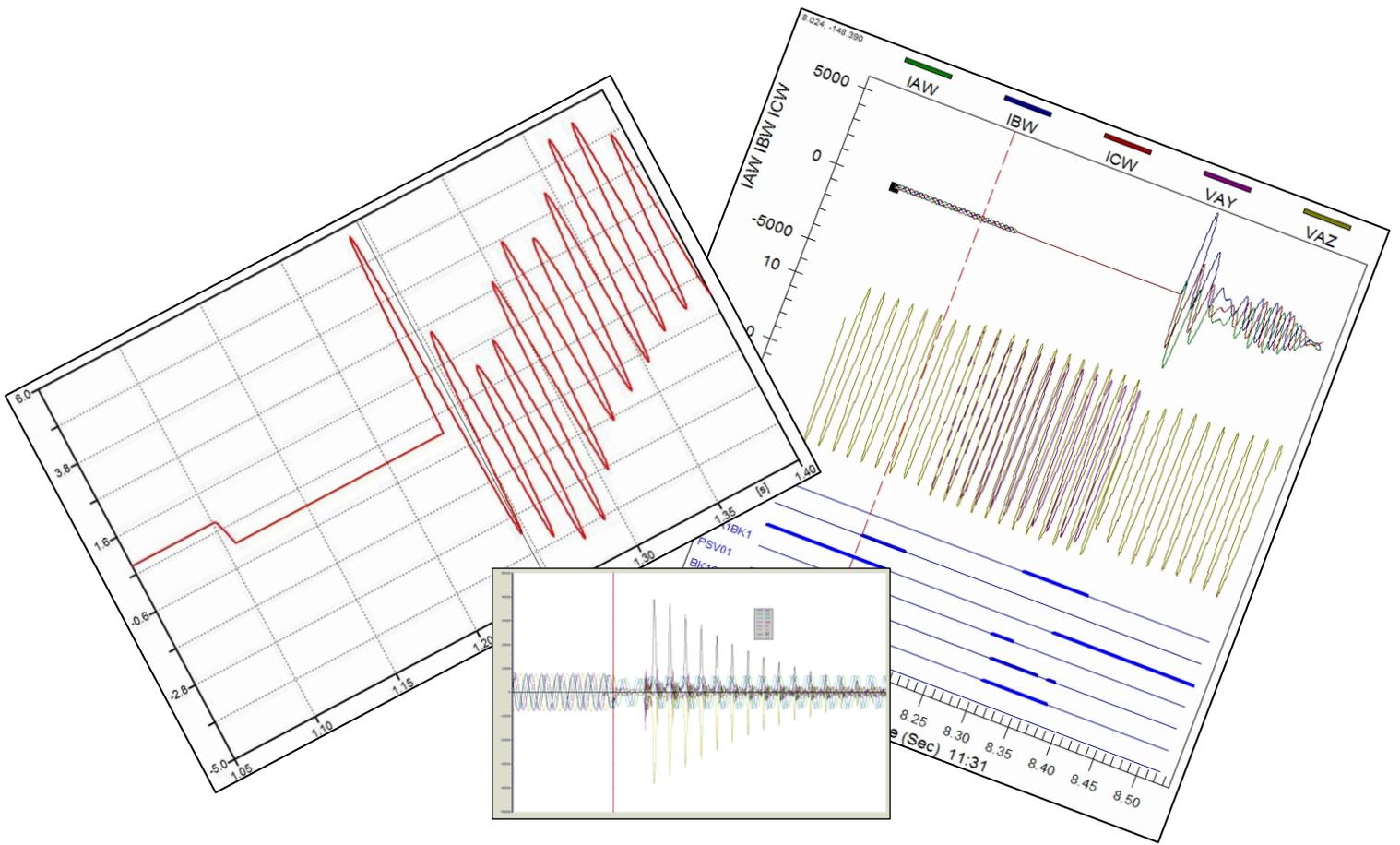


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IEEE References and Abstracts

The following list identifies several publications that provide discussions of generators, motors, and other electrical components and issues relating to out of phase connection events. Abstracts begin on page 3. Full papers - requires valid subscription - can be downloaded from IEEE Explorer at: <http://ieeexplore.ieee.org/Xplore/dynhome.jsp>.

Generators:

- Analysis Of Out Of Phase Reclosing Required For The Protection Of Dispersed Storage And Generation Units
- Assessment of Long Term Life Expenditure for Steam Turbine Shafts Due to Non Characteristic Subharmonic Currents in Asynchronous Links
- Evaluation of Torsional Efforts on Thermal Machines Shaft with Gas Turbine Resulting of Automatic Reclosing
- Modeling of Emergency Diesel Generators in an 800 Megawatt Nuclear Power Plant
- Modeling of Protective Devices for Voltage Sag Studies in Distribution Systems
- Performance of Generator Protection During Major System Disturbances
- Shaft Torques During Out of Phase Synchronization
- Stochastic Evaluation of Turbine Generator Shaft Torsional Torques in a HVAC-DC Power System
- Synchronous Machine And Torsional Dynamics Simulation In The Computation Of Electromagnetic Transients
- Torsional Fatigue of Turbine Generator Shafts Caused By Different Electrical System Faults and Switching Operations
- Validation of Out-Of-Step Protection With A Real Time Digital Simulator

Motors:

- A Critical Survey of Considerations in Maintaining Process Continuity During Voltage Dips while Protecting Motors with Reclosing
- Behavior of Induction Motor Due to Voltage Sags and Short Interruptions
- Bus Transfer Systems Requirements Implementation and Experiences

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- Comparison of Reduced Order Dynamic Models of Induction Machines
- Induction Motor Load Dynamics Impact on Voltage Recovery Phenomena
- Induction Motor Residual Voltage
- Magnitude, Amplitudes And Frequencies of Induction Motor Air Gap Transient Torque through Simultaneous Reclosing with or without Capacitors
- Minimizing the Effects of Voltage Disturbances on Continuous Industrial Processes
- Modeling of Emergency Diesel Generators in an 800 Megawatt Nuclear Power Plant
- Modeling of Protective Devices for Voltage Sag Studies in Distribution Systems
- Performance Analysis of Fast Reclosing Transients in Induction Motors
- Reclosing Torques of Large Induction Motors with Stator Trapped Flux
- Reclosing Transients in Induction Machines including the Effects of Saturation of the Magnetizing Branch And A Practical Case Study
- Techniques in Motor Starting
- The Analysis and Application of Residual Voltage of AM after AC Dump
- Transfer of Motor Loads Between Out Of Phase Sources

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Validation of Out-of-Step Protection With a Real Time Digital Simulator

Frank Plumptre, *BC Hydro*, Stephan Brettschneider, *Cegertec*, Allen Hiebert, *BC Transmission Corporation*

Michael Thompson and Mangapathirao “Venkat” Mynam, *Schweitzer Engineering Laboratories, Inc.*

Abstract—This paper describes the use of a real time digital simulator with dynamic machine models to validate out-of-step tripping and blocking elements in a new protective relaying system being installed on the BC Hydro 500 kV power system. The technique has also been used to study and validate a generation shedding remedial action scheme. This unique approach has many advantages over traditional methods of studying the effect of power swings on protection systems. Traditional methods for studying power swings are limited in their ability to predict the response of protective elements due to the fact that they model the power system in the positive-sequence network only. A real time digital simulator can represent the power system under more realistic conditions so that the response of the protective system can be tested under conditions that nearly match actual field conditions. Case studies are discussed in the paper showing the importance of this new approach.

IEEE Transactions on Power Apparatus and Systems, Vol. PAS-97, No. 5, Sept/Oct 1978

**TORSIONAL FATIGUE OF TURBINE-GENERATOR SHAFTS CAUSED BY
DIFFERENT ELECTRICAL SYSTEM FAULTS AND SWITCHING
OPERATIONS**

John S. Joyce, Senior Member
Allis-Chalmers Power Systems, Inc.
West Allis, Wisconsin Muelhe

Tadeusz Kulig and Dietrich Lambrecht
Kraftwerk Union AG
im/Ruhr, West Germany

Abstract - The torsional stresses that occur in large steam turbinegenerator shafts due to both planned and unplanned system switching operations are discussed. These operations include routine line switching, reclosing line-to-ground faults by either triple-pole or single-pole breaker operation, reclosing line-to-line and three-phase faults, malsynchronization and load rejection. The calculation of cumulative fatigue of individual turbine-generator shafts from computer-plotted torsional swing traces is explained. The benefits of single-pole breaker operation and of dividing the output of large generators between different electrical systems are briefly mentioned.

IEEE Transactions on Power Apparatus and Systems, Vol. PAS-97, no. 4 July/Aug 1978

SYNCHRONOUS MACHINE AND TORSIONAL DYNAMICS SIMULATION
IN THE COMPUTATION OF ELECTROMAGNETIC TRANSIENTS

G. Gross
Pacific Gas and Electric Co.

M. C. Hall
Southern California Edison Co.

ABSTRACT

This paper presents the development of a new time domain simulation program for the computation of machine and network transients over a wide frequency spectrum. The program uses the extensive capability for the detailed representation of, and the computation of electromagnetic transients on, the power system network available in the BPA Electromagnetic Transients Program (EMTP). The model of the synchronous generator, in which both the electrical and the mechanical shaft torsional dynamics are represented, possesses a large degree of generality. The model is interfaced with the EMTP network and a newly developed and computationally efficient numerical integration scheme is used to compute the machine transients. The option for representing arbitrary excitation systems has been implemented. The program's capability to simulate a three-phase network with an arbitrary number of synchronous machines - generators or motors - and their auxiliary control equipment, allows the evaluation of network -- machine - control systems interactions. The application of the program to investigate the subsynchronous resonance phenomenon in a realistic-sized system is given. Other typical applications include transmission line reclosure, independent pole switching, load rejection or unit tripping, loss of synchronism and multi-machine interaction problems. The program, in use for some time by a number of utilities, has been incorporated as a standard feature of the EMTP.

Stochastic Evaluation of Turbine-Generator Shaft Torsional Torques in a HVAC/DC Power System

Sherif Omar Faried, Senior Member, IEEE, and Saleh Aboreshaid, Senior Member, IEEE

Abstract—This paper presents a Monte Carlo based approach to evaluate the maximum torsional torques induced in turbine-generator shafts during faults on a HVac/dc power system. In this context, investigations have been conducted on a large turbine-generator model taking into consideration the uncertainty of various factors associated with the practical operation of a power system. The results of these investigations are presented in the form of probability distributions of the maximum torsional torques induced in the turbine-generator shaft sections. A risk index that reflects the likelihood that the torque induced in a turbine-generator shaft exceeds its design value is also presented. Moreover, the paper presents a method for calculating the expected life expenditure ratio and the expected lifetime of turbine-generator shafts.

Index Terms—High voltage direct current transmission, stochastic techniques, synchronous machines, turbine-generator shaft torsional torques.

IEEE Transactions on Power Apparatus and System, Vol. PAS-96, no. L, July/August 1977

SHAFT TORQUES DURING OUT-OF-PHASE SYNCHRONIZATION

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Energy Systems Simulation Laboratory
School of Electrical Engineering
Purdue University
West Lafayette, Indiana

P. A. Rusche
Consumers Power Company
Jackson, Michigan

ABSTRACT

As a consequence of shaft failures in two units in a Consumers Power gas turbine installation, a computer study was performed to determine the torques in the turbine-generator shaft system during out-of-phase synchronization. Prior to this study, the possible occurrence of excessive torques in the turbine-generator shaft system without damage to the stator windings due to large currents was questioned. If the gas turbine-generator unit is designed to sustain the stator currents and the instantaneous shaft torques resulting from a three phase short circuit at the machine terminals, then the results of this investigation revealed that during out-of-phase synchronization the design torques may be exceeded by 2 to 3 times without exceeding the amplitude of the short circuit stator currents. From this it seems reasonable to infer that shaft failure could occur during out-of-phase synchronization without damage to stator windings due to excessive currents.

Performance of Generator Protection During Major System Disturbances

Working Group J6 of the Rotating Machinery Protection Subcommittee,
Power System Relaying Committee

Chairperson: Subhash C. Patel, **Vice Chairperson:** Kevin A. Stephan

Members: M. Bajpai, R. Das, T. J. Domin, E. Fennell, J. D. Gardell, I. Gibbs, C. Henville, P. M. Kerrigan, H. J. King, P. Kumar, C. J. Mozina, M. Reichard, J. Uchiyama, S. Usman, D. L. Viers, D. Wardlow, M. Yalla

Keywords – AC generator protection, AC generator excitation, Turbines, Governors, Power system control.

Abstract – Disturbance is an inherent part of any power system during the transition from one steady state operating condition to the next. Protective relays may experience abnormal operating conditions during this transient period. This paper reviews various control actions that play a part during the transition and provides technical guidance to the industry on the application and setting of generator protective relays that can operate during major system disturbances.

Modeling of Protective Devices for Voltage Sag Studies in Distribution Systems

J.A. Martinez, *Member, IEEE*, and J. Martin-Arnedo

Abstract-- Characteristics of voltage sags caused by faults in transmission and distribution networks depend on the protection system performance. This paper presents the development of a library of protective devices for voltage sag studies in distribution networks using an electromagnetic transients program. The document has been divided into two parts; the first one describes the implementation of protective devices (fuses, circuit breakers, reclosers), while the second part presents some simulation results whose main goal is to analyze the coordination between different types of protective devices.

Index Terms—Power Distribution, Power Quality, Simulation, Fuses, Circuit Breakers, Reclosers.

IEEE Transactions on Energy Conversion, Vol. 8, No. 3, September 1993

MODELING OF EMERGENCY DIESEL GENERATORS IN AN 800 MEGAWATT NUCLEAR POWER PLANT

K.E. Yeager, Member IEEE J.R.
Consumers Power Company Power
Jackson, Michigan Schenectady,

Willis, Member IEEE
Technologies, Inc.
New York

Abstract - Computer models have been developed of emergency diesel generators and their associated emergency core cooling system induction motors during sequencing and results compared with field tests. Models required to perform studies of emergency diesel generators in a nuclear plant are presented. Field measurements indicating different response of two seemingly identical generator excitation systems are discussed. Results of 480 volt ac contactor dropout testing are provided for determining voltage limits in the 480 volt system during motor starting transients.

Keywords - Diesel Generators, Induction Motors.

Evaluation of Torsional Efforts on Thermal Machines Shaft with Gas Turbine resulting of Automatic Reclosing

Alvaro J. P. Ramos, Wellington S. Mota, Yendys S. Dantas

Abstract— This paper analyses the torsional efforts in gas turbine-generator shafts caused by high speed automatic reclosing of transmission lines. This issue is especially important for cases of three phase short circuit and unsuccessful reclosure of lines in the vicinity of the thermal plant. The analysis was carried out for the thermal plant TERMOPERNAMBUCO located on Northeast region of Brazil. It is shown that stress level caused by lines unsuccessful reclosing can be several times higher than terminal three-phase short circuit. Simulations were carried out with detailed shaft torsional model provided by machine manufacturer and with the “Alternative Transient Program – ATP” program [1]. Unsuccessful three phase reclosing for selected lines in the area closed to the plant indicated most critical cases. Also, reclosing first the terminal next to the gas turbine generator will lead also to the most critical condition. Considering that the values of transient torques are very sensible to the instant of reclosing, simulation of unsuccessful reclosing with statistics ATP switch were carried out for determination of most critical transient torques for each section of the generator turbine shaft.

Keywords—Torsional Efforts, Thermal Machine, Gas Turbine, Automatic Reclosing.

Assessment of Long-Term Life Expenditure for Steam Turbine Shafts Due to Noncharacteristic Subharmonic Currents in Asynchronous Links

Jong-Ian Tsai, Chi-Hsiung Lin, and Ta-Peng Tsao

Abstract—In this paper, the long-term effect of noncharacteristic subharmonic currents in a HVDC link on the fatigue life loss in turbine-generator shafts is analyzed. As soon as the asynchronous operation in HVDC links takes place, the disturbing rotor frequency distributions on both ac sides of the main harmonics are exactly subsynchronous. To completely investigate the long-term effects of inevitable asynchronous operation, a systematic scheme is motivated to examine the concerned fatigue life expenditure level. The simulation results show the influences under various operating conditions and prove the potential long-term failure of shafts due to such electrical disturbances. It is also justified that even though the shafts could withstand the most severe impact subject to a three-phase-to-ground fault, it still cannot guarantee long-term safety operations even under normal operating conditions.

Index Terms—Electromagnetic torque (E/M torque), fatigue life expenditure, harmonics, HVDC, torsional vibration, turbine shaft.

ANALYSIS OF OUT OF PHASE RECLOSING REQUIRED FOR THE PROTECTION OF DISPERSED STORAGE AND GENERATION UNITS.

O Usta*, M A Redfern**, N Tarkan" and Z Erdogan*

*Istanbul Technical University, Turkey

**University of Bath, England

Abstract: One of the most important protection requirements of a Dispersed Storage and Generation (DSG) unit is to provide protection against islanding and hence to prevent out of phase reclosing with the utility source which may occur following an undetected islanding condition. The possible effect of an out of phase reclosing to a power system containing a DSG unit has been analyzed in this work. In addition, the response of the DSG protection system to an out of phase reclosing created by a remote circuit breaker has also been evaluated. Computer simulation and test studies show that the rate of change of power protection algorithm, which is initially designed for islanding protection also shows a very good performance for reliable detection of out of phase reclosing conditions.

IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, VOL. IA-15, NO. 4,
JULY/AUGUST 1979

Transfer of Motor Loads Between Out-of-Phase Sources

JOHN D. GILL, SENIOR MEMBER, IEEE

Abstract-An inrush current normally occurs when a motor is momentarily disconnected from a source of power and is immediately reconnected to an alternate source of power. The magnitude of the inrush current may substantially exceed the normal starting current of the motor. The mechanical shock to the system may create cumulative damage to the motor shaft and windings resulting in reduced life if not immediate failure. The thermal and/or magnetic shock to the system can result in nuisance opening of overcurrent protective devices. Test data are presented showing how in-rush currents drawn by a motor vary for different transfer conditions, and one method for minimizing such currents is explained.

The Analysis and Application of Residual Voltage of AM after AC Dump

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'College of Electrical Engineering, Hohai University, Nanjing 210098, China

²Department of Electrical Engineering, Southeast University, Nanjing 210096, China

Abstract - Residual Voltage of AM after AC Dump (RVACD) is the universal phenomenon for induction motor. This paper has carried out study on the RVACD. It establishes simulation model for RVACD, then carries out simulation calculation. Based on this, the RVACD's mechanism, affecting factors, the changing rule of magnitude, frequency component and changing rule, etc are analyzed. Under rotor winding fault, induction motor will generate particular frequency component in RVACD. This is analyzed in this paper. The effort to diagnose rotor winding fault based on RVACD is studied in this paper. The experimental measurement is carried out to prove the research conclusions. They are basically in accordance with each other.

Keywords - Residual voltage after AC dump(RVACD); Asynchronous motor; Fault diagnosis

TECHNIQUES IN MOTOR STARTING

Timothy Albers Christopher Cade Steven Ruffing Freeman Robinson
Senior Member, IEEE Engineering Manager Member, IEEE Senior Design Engineer

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Abstract - This paper is intended to serve as a guide and reference document for all facets of starting of induction AC Motors. Covered topics include; NEMA starting design letters, IEC versus NEMA starting, Starting methods, Starting adjustable speed Drives, Inertial effects on acceleration, Starting cycles, Thermal protective devices in starting, quick restarts and other starting topics.

Index Terms - Motors, Starting Methods, Current Draw, Load Inertia

IEEE Transactions on Energy Conversion, Vol. 9, No.2, June 1994 383
RECLOSING TRANSIENTS IN INDUCTION MOTORS
INCLUDING THE EFFECTS OF SATURATION OF THE
MAGNETIZING BRANCH AND A PRACTICAL CASE STUDY

by

I.Reynaud and P.Pillay
Department of Electrical Engineering
University of New Orleans
LA 70148

Abstract

Induction motors make up the majority of the load in many industries. The industry is becoming increasingly aware of the need to ride through short term faults on the power system to improve the system reliability, particularly where motors drive critical loads. This often requires reclosing on the motor before it has reached zero speed. Such reclosures can damage the motor due to excessive current and torque transients. This paper examines the reclosing transients in an induction motor, including the effects of saturation. A practical case study is also presented with speed and back emf measurements from a 20 hp induction motor driving a mixer in an oil refinery.

RECLOSING TORQUES OF LARGE INDUCTION MOTORS WITH STATOR TRAPPED FLUX

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M. AL-Omoush

Dept. of Electrical Power and Machines
Faculty of Engineering
Cairo University, Giza, Egypt

Electrical Power Department
Hijawi Faculty of Applied Engineering
Yarmouk University, Irbid, Jordan

Abstract-Large induction motors are subjected to high transient torques following the rapid reconnection of the supply. The paper shows, that these torques have oscillatory components with speed dependent frequencies. These components may result in high torsional torques if the supply is reconnected at unfavorable instant; when the frequency of one of the torque components coincides with the natural torsional frequency. However, this high torque can be avoided by the proper choice of the reclosing instant.

KEYWORDS: Induction motors, circuit breaker reclosures, torsional torques

IEEE Transactions on Energy Conversion, Vol. 14, No. 1, March 1999

PERFORMANCE ANALYSIS OF FAST RECLOSING TRANSIENTS IN INDUCTION MOTORS

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Abstract. Induction motors are used extensively in the heavy industry. For these loads, this often requires reclosing on the motor before it reaches zero speed. However, if the supply voltage is applied before the motor reaches zero speed, the motor can be damaged due to excessive current and torque transients. This paper presents a performance analysis of fast reclosing transients in induction motors. It is shown that the optimum time instant for reclosing depends upon the supply voltage and load parameters. The results indicate that the maximum absolute value of instantaneous torque occurs in the first cycle and for every time cycle of supply voltage. In fact, there are at least one positive peak and one negative peak for the torque.

Modeling of Protective Devices for Voltage Sag Studies in Distribution Systems

J.A. Martinez, *Member, IEEE*, and J. Martin-Arnedo

Abstract-- Characteristics of voltage sags caused by faults in transmission and distribution networks depend on the protection system performance. This paper presents the development of a library of protective devices for voltage sag studies in distribution networks using an electromagnetic transients program. The document has been divided into two parts; the first one describes the implementation of protective devices (fuses, circuit breakers, reclosers), while the second part presents some simulation results whose main goal is to analyze the coordination between different types of protective devices.

Index Terms—Power Distribution, Power Quality, Simulation, Fuses, Circuit Breakers, Reclosers.

IEEE Transactions on Energy Conversion, Vol. 8, No. 3, September 1993

MODELING OF EMERGENCY DIESEL GENERATORS IN AN 800 MEGAWATT NUCLEAR POWER PLANT

K.E. Yeager, Member IEEE J.R.
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Abstract - Computer models have been developed of emergency diesel generators and their associated emergency core cooling system induction motors during sequencing and results compared with field tests. Models required to perform studies of emergency diesel generators in a nuclear plant are presented. Field measurements indicating different response of two seemingly identical generator excitation systems are discussed. Results of 480 volt ac contactor dropout testing are provided for determining voltage limits in the 480 volt system during motor starting transients.

Keywords - Diesel Generators, Induction Motors.

MINIMIZING THE EFFECTS OF VOLTAGE DISTURBANCES ON CONTINUOUS INDUSTRIAL PROCESSES

K.W. Carrick
Member, IEEE
BP Oil, Alliance Refinery

ABSTRACT : The continuous industrial process considered to be within the scope of this paper is defined. Typical process plant reaction to power interruption and voltage sags is described and the characteristics of the voltage sags experienced by continuous process plants are discussed. The reaction of process and motor control components is described. Methods of minimizing the adverse reaction to voltage disturbances by manipulation of the control component circuit configuration and/or manipulation of the control power supply are presented.

IEEE Transactions on Power Apparatus and Systems, Vol. PAS-104, No. 6, June 1985

MAGNITUDE, AMPLITUDES AND FREQUENCIES OF INDUCTION-MOTOR AIR-GAP TRANSIENT
TORQUE THROUGH SIMULTANEOUS RECLOSING WITH OR WITHOUT CAPACITORS

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Heavy Industry Motor Division
Westinghouse Electric Corporation
Round Rock, Texas

Provi
Res

Abstract

Knowing the magnitude, the frequencies and the amplitudes of the air-gap transient torque will definitely help the engineer to steer the design away from any destructive transient situation shown at the early design stage. With this objective in mind, this paper analyzed the simultaneous reclosing (or starting) of an induction motor under constant speed with or without capacitors. The frequencies and amplitudes of reclosing transient torques are very different when the motor is reclosed at different slips. Sample case study showed that as far as simultaneous reclosing is concerned the ANSI C50.41 or NEMA MG-1 on reclosing does not have practical meaning in limiting the magnitude of the simultaneous reclosing transient torque. Reclosing and starting tests conducted on a 2500/1250-HP, 10/12-pole motor agreed with the calculations.

INDUCTION MOTOR RESIDUAL VOLTAGE

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Kanagawa Institute of Technology, JAPAN

Abstract

The residual voltage in an induction motor under interrupted power supply condition should be seriously considered under the present status of the vast needs for high capacity and high speed induction motors. Concerning this problem, the electromagnetic shock at its coil end, due to the excessive surge current when the power line is switched over, and the mechanical system impact due to the greater transient torque, must be specially investigated for practical operation. In this paper, the bus residual voltage problem is set as the study target, specially for the case when many induction motors are connected to a common bus. Furthermore, the analytical method used in this problem and the rapid decay of the residual voltage are demonstrated, together with the comparative investigation with the test results.

Induction Motor Load Dynamics: Impact on Voltage Recovery Phenomena

George K. Stefopoulos, *Student Member, IEEE*, A. P. Meliopoulos, *Fellow, IEEE*
School of Electrical and Computer Engineering, Georgia Institute of Technology,
Atlanta, GA 30332

Abstract—This paper addresses the impact of load dynamics, and in particular induction motor loads, on voltage recovery after disturbances. The paper proposes a methodology that is based on load flow techniques with advanced modeling capabilities, augmented by a simplified induction motor dynamic model. The objective is to realistically capture the dynamic characteristics of voltage recovery phenomena, avoiding, however, the full scale transient simulation. The approach uses the quadratized power flow model with explicit induction motor representation. The paper describes the modeling approach and the overall methodology for evaluating the load dynamics on voltage recovery. Preliminary results of the application of the method on a simple power system with load dynamics are also included in the paper.

Index Terms— Dynamic load modeling, Induction motor model, Load flow analysis, Voltage recovery

Comparison of Reduced-Order Dynamic Models of Induction Machines

Torbjörn Thiringer, *Member, IEEE* and Jorma Luomi, *Member, IEEE*

Abstract—The paper deals with the validity of various dynamic models of induction machines. The fifth-order Park model and various reduced-order models are used to predict the low-frequency dynamic response of a 15 kW induction machine, and the theoretical results are compared with an extensive series of measurements. Several transfer functions are investigated in the perturbation frequency region below 35 Hz using three types of basic excitations: perturbations in the shaft torque, supply voltage and supply frequency. The maximum perturbation frequency for an error less than 10% is used to study the validity range of the models; this range is evaluated for each model and transfer function, using the data of 31 different machines. The influence of the machine parameters and various physical phenomena is studied. The results show that a large number of transfer functions is needed for judging the general validity of a dynamic model.

Index Terms—Dynamics, induction machines, modeling.

IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, VOL. 39, NO. 1,
JANUARY/FEBRUARY 2003

Bus Transfer Systems: Requirements, Implementation, and Experiences

Amit Raje, *Member, IEEE*, Anil Raje, Jack McCall, *Member, IEEE*, and Arvind Chaudhary, *Senior Member, IEEE*

Abstract—A bus transfer system is designed to provide process continuity to the loads attached to a motor bus while transferring the bus from one source to another. A successful bus transfer under contingent conditions provides immense value and benefits to continuous process operations that cannot afford an interruption of power supply to plant auxiliaries. This paper describes some real-world bus transfer requirements, implementations, and experiences in thermal power plants and continuous process industry plants. The fast, in-phase, residual voltage, and momentary paralleling transfer methods are described, compared, and evaluated. The spin-down characteristics for different motor buses are analyzed, and the feasibility of the different transfer modes is deduced. Auto- initiation criterion for bus transfer is explored, using a combination of bus undervoltage, underfrequency, and (df/dt) characteristics. Different integrated system requirements, such as monitoring of readiness conditions, breaker failure detection and corrective action logic, and online testing measures, are discussed. The results of the resultant “hot” load trials and their benefits to the system are explained and interpreted. The concept of islanded transfer for grid-free operations of captive generation-load systems is discussed and elaborated.

Index Terms—Automatic bus transfer (ABT), bus transfer system (BTS), continuous process, fast, in-phase, islanding, residual voltage.

Behavior of Induction Motor Due to Voltage Sags and Short Interruptions

Juan C. Gomez, *Member, IEEE*, Medhat M. Morcos, *Senior Member, IEEE*, Claudio A. Reineri, and Gabriel N. Campetelli

Abstract—An experimental study and some calculations on induction motor behavior were carried out. The effects due to short interruptions and voltage sags were investigated. A standard three-phase squirrel-cage motor of 5.5 kW, 1500 r/min, and 380 V was used. The presence of induction motor changes the voltage sag waveform and duration. Protection characteristic curves and contactor ride-through capability together with their improvement are also studied. The interaction between motor load, system hot-load pickup, and voltage sag magnitude determine the motor re-acceleration duration and magnitudes. Besides, on-sag and post-sag currents can reach levels higher than the direct start values. Post-sag overcurrent duration can last more than twice the normal start time period, having specific energies in the same order of magnitude.

Index Terms—Hot-load pickup, induction motor, motor reacceleration, power quality, short interruptions, voltage sags.

Stochastic Evaluation of Turbine-Generator Shaft Torsional Torques in a HVAC/DC Power System

Sherif Omar Faried, Senior Member, IEEE, and Saleh Aboreshaid, Senior Member, IEEE

Abstract—This paper presents a Monte Carlo based approach to evaluate the maximum torsional torques induced in turbine-generator shafts during faults on a HVac/dc power system. In this context, investigations have been conducted on a large turbine-generator model taking into consideration the uncertainty of various factors associated with the practical operation of a power system. The results of these investigations are presented in the form of probability distributions of the maximum torsional torques induced in the turbine-generator shaft sections. A risk index that reflects the likelihood that the torque induced in a turbine-generator shaft exceeds its design value is also presented. Moreover, the paper presents a method for calculating the expected life expenditure ratio and the expected lifetime of turbine-generator shafts.

Index Terms—High voltage direct current transmission, stochastic techniques, synchronous machines, turbine-generator shaft torsional torques.