THE INFLUENCE OF LOAD LEVEL ON CURRENT DEFORMATION IN AC PERMANENT MAGNET MOTOR

Abstract: This paper presents the influence of load level on harmonic contents in line start permanent magnet synchronous motor. All known methods leading to minimization harmonics concern only permanent magnet flux distribution and no load back EMF. Meanwhile studies carried out for 2 HP LSPMSM show that harmonics level depends on load level. It is connected with armature reaction flux and non-uniform magnetic reluctance along rotor circumference. Results of FEM calculation including flux pattern and normal component of flux density along an airgap are presented. Harmonics of phase current as a function of load torque are also shown.

THE MATHEMATICAL MODEL OF POLYMERIZER DRIVE CONSIDERING SELECTED PROCESSING PROBLEMS – PART I

Abstract: In the paper a mathematical model of polymerizer drive with specially designed induction motor is presented. Moments of inertia in mechanical system of polymerizer drive were calculated using the methods proposed by authors and results are also presented in the paper. The advantage of mentioned methods is precision of calculations even if the analytical calculations with the use of approximate dependences are applied. The results of calculations are used in mathematical model considering kinematic structure of polymerizer drive that is presented in the second part of paper. In the next step a transient states numerical analysis using polymerizer drive mathematical model are made to develop and construct the specially designed induction motor prototype. The motor has a pipe frame; construction of rotor and suspension system is adapted for a vertical work. A large size-diameter slide bearing made of sintered carbides and cooled with ethylene stream is applied in the motor. The motor is fed by special electrodes and it is adapted into the work in the reactor chamber with a pressure of a 2800 atm.

THE MATHEMATICAL MODEL OF POLYMERIZER DRIVE CONSIDERING SELECTED PROCESSING PROBLEMS – PART II

Abstract: The second part of the paper continues a presentation of the work on polymerizer drive mathematical model. Selected examples of transient states numerical analysis of polymerizer drive are included. The aim of the work was to develop and construct the specially designed induction motor prototype adapted for a vertical work in the reactor chamber with the pressure of a 2800 atm. The mathematical model of polymerizer drive was formulated basing on mathematical model of mechanical system with conservative elements and discrete division of working mixer. Real load of a mixer resulted from polymerization process and specially designed induction motor was taken into consideration. Moments of inertia in polymerizer drive were calculated and results were presented in the first part of the paper. The moments of inertia are used in mathematical model of considered kinematic structure presented in the paper. The works on polymerizer drive mathematical
model and prototypes of specially designed induction motor were designed in the frame of purposeful grant no. 6T10 2003C/06105 financially supported by Ministry of Education and Science.

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ANALIZA MODELOWA WPŁYWU ODŁĄCZENIA I PONOWNEGO ZAŁĄCZENIA NAPIĘCIA SIECI NA STANY DYNAMICZNE SILNIKA ASYNCHRONICZNEGO

A MODEL ANALYSIS OF INFLUENCE OF DISCONNECTION AND A FOLLOWING CONNECTION OF NETWORK VOLTAGE ON THE DYNAMIC STATES OF AN INDUCTION MOTOR

Abstract: The model for simulation the influence of the supply interruption on the dynamic states of an induction motor is presented. The model was employed to simulation of the three-phase balanced supply interruption (voltage and currents) and the voltage phase shift in the subsequent voltage recovery. The analysis of the electromotive force, currents, torque, speed provides information about the influence of the supply interruption and the field suppression rate on the dynamic performance of a motor after the supply recovery. The influence of the voltage phase shift on the motor operation has been analysed for various values of the moment of inertia and various interruption time. The simulation was carried out using the Matlab package.

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ANALIZA WYBRANYCH STANÓW PRZEJŚCIOWYCH PODCZAS ROZRUCHU CZĘSTOTLIWOŚCIOWEGO SYNCHRONICZNEGO SILNIKA RELUKTANCYJNEGO

TRANSIENT ANALYSIS OF ALA SYNCHRONOUS RELUCTANCE MOTOR DURING FREQUENCY CONTROLLED STARTING

Abstract: The paper deals with computer based simulations of frequency controlled starting up of two pole synchronous reluctance motor with axially laminated, anisotropic rotor. A field-circuit model was used, with magnetic circuit non-linearity taking into account. The model was implemented in Matlab/Simulink environment and is presented in fig. 3 and 4. A series of simulation were done for different values of start up parameters: initial voltage, initial frequency, frequency slope, shaft load, moment of inertia. The simulation results show, that, at some conditions, significant lack of stability may occur during start up. Especially, fast start up at no load, high moment of inertia and low initial voltage may be impossible – the motor pulls out of synchronism. The possible cause of observed occurrence and ways of overcoming that phenomenon, both through a proper control and adequate modification of design, were proposed.

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OCENA WŁAŚCIWOŚCI UKŁADÓW PRZEKSZAŁTNIKOWYCH (FOC, DTC, DTC-SVM) ZASILAJĄCYCH MASZYNĘ INDUKCYJNĄ

EVALUATION OF THE PROPERTIES OF THE INVERTER (FOC, DTC, DTC-SVM) FED AC MOTOR
Abstract: The most articles presenting the new control method of DC/AC inverters feeding AC motors still exhibited their advantages are biased against another known methods. It is consequence a lack of complete knowledge concerning the competitive methods. The most objective are a reviewed articles but their limitations prevents authors from the exactly methods comparison. In the scientific papers the technical properties are the most frequently presented. For the system users additionally the economic aspect especially during exploitation process is very important. The economic effectiveness during exploitation depends on a repair costs connected with device reliability and on the energy conversion efficiency. The converter reliability to a large degree depends on producer experience and on the used method of control. The users often are looking on the devices technical properties and do not attach importance to a few percentage of efficiency, which during long-lasting operation has important economic aspect. Additionally, the converter efficiency has also influence its method of control. The technical aspects alternating with economical aspects, therefore the very important problem presents the comparison of well-known methods of control (DTC, DTC-SVM, FOC).

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NOWY, NIELINIOWY REGULATOR PRĄDU A DYNAMIKA KSZTAŁTOWANIA MOMENTU SILNIKA INDUKCYJNEGO

THE NOVEL NON-LINEAR CURRENT REGULATOR
– DYNAMIC TORQUE FORMING OF AC MOTOR

Abstract: This paper describes a possibility of the new, non-linear current controller usage. This current controller was compared with delta modulation controller. By the predictive current controller usage the current shape quality was improved. The $\text{THD}_I$ coefficient of the output current was reduced about 30%. The average magnitude of the current error vector was decreased about 40%. It causes less power losses and less torque fluctuations of induction machine. Simultaneously with $\text{THD}_I$ decrease, the reduction of transistors switching number was achieved. The switching frequency of DC/AC inverter was reduced about 94% at low motor speed range in comparison to delta modulation controller use. It means the inverter efficiency improvement. The predictive controller has not disadvantage of delta modulation controller called as average current error. The new current controller keep extremely good dynamics in transient state comparable to delta modulation controller. It was shown on experimental research. The new, non-linear current controller and control system of DC/AC inverter was realized by microprocessor system usage. It ensure good dynamics of torque forming and better efficiency of combined, inverter-motor system.

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ZAGADNIENIA DOBORU PRZEMIENNIKÓW CZĘSTOTLIWOŚCI DO ZASILANIA SILNIKÓW RELUKTANCYJNYCH O ROZRUCHU ASYNCHRONICZNYM

SELECTION ASPECTS FREQUENCY CONVERTERS FOR POWERING RELUCTANCE MOTORS WITH ASYNCHRONOUS START-UP

Abstract: The paper presents test results concerning the influence of the kind of frequency converter used on static and dynamic parameters of a drive with reluctance motor at asynchronous startup. Vector- and scalar controlled converters most widely applied in the industry underwent tests. It was found that there exists the dependence between the kind of converter employed and the parameters of the drive with this type of reluctance motor. The frequency of input voltage modulation also influences the dynamic parameters. Basing on the study carried out, it was demonstrated that SVL vector controlled converters should be mainly used for the powering of such kind of motors. Vector controlled frequency converters of higher quality may introduce engine trouble, as far as the work of drives with such motors is concerned.

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WPŁYW RODZAJU WYMUSZENIA NA WYBÓR STRUKTURY STEROWANIA WEKTOROWEGO

SELECTION OF A VECTOR CONTROL STRUCTURE DEPENDING ON THE KIND OF AN INPUT SIGNAL

Abstract: Vector control of induction motor torque and speed yields very good static and dynamic properties. Systems that apply such control become a standard solution that is widely used even for drives of high requirements. When vector control is applied aside with amplitudes and frequencies phases of rotational vectors of motor currents and flux linkages are determined. Correct orientation of the vectors can be maintained due to the control system both in steady and transient states. In the paper field-oriented vector control is discussed and kinds of input signals for that type of control are determined. Kind of an input signal is important for the motor operation as its dynamic properties get essentially changed then. Particular attention has been paid to voltage and current signals and control possibilities have been determined for each of them. Additionally, attention has been paid to the selection of control orientation with respect to the vector of magnetic field in the motor.

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POŚLIZGOWA CHARAKTERYSTYKA ADMITANCJI STOJANIA SILNIKA INDUKCYJNEGO UZYSKANA PRZY ZASTOSOWANIU SYMULACJI KOMPUTEROWEJ

SLIP CHARACTERISTIC OF INDUCTION MOTOR ADMITTANCE STATOR OBTAINED WITH THE APPLICATION OF COMPUTER SIMULATION

Abstract: Slip characteristic of induction motor admittance is the admittance locus at varied slip and constant frequency of feeding voltage. Circle diagram can graphically represent the characteristic only in the case when electromagnetic parameters of a machine are constant. Circle diagram makes an important tool at the evaluation of an asynchronous motor operation. Based on the diagram it is possible to find for an arbitrary slip not only values of electrical parameters but also mechanical parameters such as torque, mechanical power and rotational speed. The paper presents a comparative analysis of classical methods for circle diagram elaboration and of their accuracy. Computer simulation of an admittance slip characteristic has been performed with the Matlab-Simulink software, based on dependences that determine admittance of a motor. The analysis concerns conditions when equivalent network parameters of an asynchronous motor are constant and the characteristic is represented by a circle. When electromagnetic parameters of a motor are not constant then the characteristic essentially differs from a typical circle diagram. It mainly concerns a squirrel-cage motor with closed slots in the rotor, fed with high-frequency voltage. In the mentioned case saturation of the closure occurs under the influence of a leakage flux. It has been shown that a shape of the characteristic depends on many parameters of a motor as well as on the way the leakage reactance changes.

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POLOWO–OBWODOWY MODEL I PARAMETRY DWUBIEGOWEGO SILNIKA SYNCHRONICZNEGO DUŻEJ MOCY

FIELD–CIRCUIT MODEL AND PARAMETERS OF TWO SPEEDS SYNCHRONOUS LARGE POWER MOTORS

Abstract: In this paper the calculation results of a two–speed synchronous, silent–pole, high power motor, are presented. Using the FEM tool Maxwell 2D, the two dimensional, field–circuit model for the large power motor, type GAe 1510/12p was examined. The simulations, for load, for both rotational speeds, for two configurations of field winding (work with eight or ten active poles of rotor), were conducted. Goal of this work is to determine the properties and the parameters of the two speed synchronous motors, with changing the pole number of magnetic field. Harmonic analysis of the armature currents and the voltages were done. The scope of the compensation of reactive power is done as well. A comparison between the calculated and measured results of physical quantities for load, in this synchronous motor is presented. The differences
between the calculated and the measured results are less than 5%. It is accepted, that the introduced model can be used in evaluation of electromagnetic and mechanical phenomenons occurring in different states of motor operation.

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OBLCZANIE CHARAKTERYSTYK ELEKTROMECHANICZNYCH SILNIKA RELUKTANCYJNEGO DOWZBUDZANEGO MAGNESAMI TRWAŁYMI

CALCULATION OF ELECTROMECHANICAL CHARACTERISTIC CURVES OF PERMANENT MAGNET ASSISTED SYNCHRONOUS RELUCTANCE MOTOR

Abstract: In the paper one of the methods for calculation of lumped synchronous parameters of PMSM, LSPMSM and PMSynRM is described. This method, called usually the loading method, was introduced by M.A. Rahman and P. Zhou at the beginning of 90’s [1, 2, 3]. The method is based on a finite element analysis of magnetic field inside the machine and simultaneous solving equivalent circuit equations of synchronous motor for a range of loads. At the Research And Development Centre Of Electric Machines “Komel”, the software for analysis and evaluation of LSPMSM and PMSynRM performance at synchronous operation was developed on the basis of loading method. The examples of electromechanical characteristic curves calculated for PMSynRM using loading method and developed software are presented in the paper.

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NAPĘD ELEKTRYCZNYCH ŁOKOMOTYW DOŁOWYCH I JEGO ROZWÓJ W KOPALNIACH

THE UNDERGROUND LOCOMOTIVES AND THEIR DEVELOPMENT

Abstract: In the article there was presented the history of coal-mine locomotives and their development. There were describrd characteristic types of the coal-mine locomotives used in the past till nowadays.

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WYBRANE ZAGADNIENIA STABILNOŚCI TRAKCYJNYCH UKŁADÓW NAPĘDOWYCH STEROWANYCH IMPULSOWO

SELECTED PROBLEMS OF STABILITY OF PULSE-MODE CONTROLLED TRACTION DRIVE SYSTEMS

Abstract: New controllable power semiconductor devices make the high frequency pulse-mode operation of the power electronic converters in traction drive systems possible. The capacity and inductance of the converter input filter limiting the ripple of the traction network voltage and current can be decreased for this reason. However, the significant change of the parameter values of these elements can be unacceptable due to necessity to ensure the stable operation of the pulse-mode control system. Results of analytical research, computer-aided simulation and laboratory research concerning stability of the pulse-mode controlled drive system with the electric mining locomotive’s traction motor are presented in this paper. On the basis of the traction system simplified model consisting of the energy source, traction network, input filter and drive system, the analysis of system operation was carried out. The non-linear differential equations describing the system were formulated and the points of balance were calculated. The relationships concerning the minimum value of the filter capacity ensuring proper work of the system were obtained on the basis of stability conditions. The waveforms of voltages in the system in stable and unstable working conditions obtained as result of computer simulation using Maple program are shown in the paper. Selected results of laboratory tests of the stability of the traction drive system equipped with the current and speed controllers are also shown here. The specific attention was paid to the influence of the filter capacitor capacity, line resistance and load current on the filter capacitor voltage fluctuations.
Influence of System Control of Excitation Current Value on Synchronization Process in Synchronous Motors

Abstract: The work presents calculation results of synchronization process of a two-speed, silent-pole, high power synchronous motor. The calculations were based on the examined two-dimensional, field-circuit model for the high power motor, type GAe 1716/20p with switchable configuration connection of armature winding and field magnet. The influence of the synchronization moment on stator currents, electromagnetic torque and shaft velocity, during synchronization process with nominal excitation voltage and high value of load torque, was examined. The influence of the excitation voltage value greater than nominal, during synchronization process with high value of load torque, on stator currents, electromagnetic torque and shaft velocity was analyzed. The influence of the method control of excitation current, during synchronization process with high value of load torque was also investigated. Dynamic diagrams of stator currents, excitation current, excitation voltage, electromagnetic torque and shaft velocity during synchronization process as results of computer simulation are presented.

Problems of Power Losses of Traction Direct Current Motors at Calculations of Energy Saving Traffic of Tram Vehicles

Abstract: The suitable control of the tram vehicle at various disturbances of the city traffic can ensure the electric energy savings equal to even 30 %. The author of this work continues with elaboration of computer software making possible realization of the tram vehicle run according to the criterion of the minimum energy use. In literature, the problem of the energy saving ride was solved for the tram vehicle only at the assumption that the running of the tram is realized without the traffic disturbances, for the separated, straight and horizontal tracks. Computer software for these idealized run conditions couldn’t applied in real routs and literature methods weren’t introduced to the energy saving control of tram vehicles. Within the original methodics of the author, the following new phenomena are taken into consideration: an influence of traffic disturbances, changes of motion resistances, interaction of different vehicles. In the typical, dynamical ride of a tram, great changes of values of motor losses occur within resistance, iron and mechanical losses. This effect has been here analysed and taken into account for algorithm of an energy saving traffic of a tram.

The Electric Hybrid Drive for a City Vehicle

Abstract: This paper presents an alternative solution of the electric hybrid drives for a city vehicle. The drive include an internal combustion engine and an electric machine with permanent magnets which works as motor or generator, in dependence on demands. Use of a dual energy storage including batteries and supercapacitors is the innovative approach to the problem. A reversible dc-dc power electronic converter transfer the energy from energy storage to electric machine during the vehicle starts and accelerate, and transfer the energy from electric machine to energy storage when the vehicle slow-down. The power transmission system is control by the microprocessor unit system.
PROJEKTOWANIE OPTYMALNYCH SILNIKÓW INDUKCYJNYCH TRÓJFAZOWYCH

DESIGN OF THE OPTIMAL THREE-PHASE INDUCTION MOTORS

Abstract: This paper presents an application of evolutionary methods for optimization of the three-phase induction motors by means of nonlinear integer programming with the turn number and the wire diameters of the windings treated as independent discrete variables. The set of the independent variables is extended by including dimensions of the rotor slot nick, and all dimensions of the both cages of double-cage rotor. Optimization with extended set of independent variables enables to obtain better solutions than with usually applied reduced set, which consists only: diameter of the starting cage bar; diameter of the upper semicircle of work cage bar and highness between upper and lower semicircles of the work cage bar. The fundamental optimization criterion is the sum of costs of active materials spend in the manufacturing and cost of energy losses by exploitation in arbitrarily chosen time. Elaborated software enables the change of optimization criterion. This enables for example designing of the rotor with maximal starting goodness for the ready made stator. In the paper the exemplary calculation results of double-cage motors rated power from 7.5 kW up to 75 kW is presented.

PROPOZYCJE NOWYCH METOD WYZNACZANIA SPRAWNOŚCI SILNIKÓW INDUKCYJNYCH KLATKOWYCH

PROPOSITIONS OF NEW METHODS OF INDUCTION SQUIRREL-CAGE MOTOR EFFICIENCY DETERMINATION

Abstract: A definition and kinds of efficiency determination methods, models of power flow and selected efficiency determination methods by standards: Japanese JEC, American IEEE 112, International IEC 60034-2 and the latest IEC 61972 and proposition of the newest methods prepared by the author are presented in this work. There are presented distributions of losses in induction squirrel-cage motor applied in particular methods, too. In this work are characterized efficiency determination methods, underlining the differences among them. There are compared the values of efficiency from different methods for the same motor and features of particular methods and presented current world tendency in progress of efficiency determination methods in induction squirrel-cage motors.

STANY DYNAMICZNE W RZECZYWISTYM SAMOTOKOWYM UKŁADZIE ELEKTROMASZYNOWYM /SUE/ Z SILNIKIEM Sg 132 M-6B-S ZASILANYM Z ACS 600 LUB SIECI 3X380 V

DYNAMIC STATES IN REAL ROLLER TABLE ARRANGEMENT ELECTROMECHANICAL /RTAE/ WITH ENGINE Sg 132 M -6B- S POWER SUPPLY FROM ACS 600 OR 3X380 V

Abstract: Article introduces dynamic states in RTAE of type 2SM-HCS for choose burden of roller tables of transporting line. Analysis is accomplished with of system for power supply as well as from converter of frequency.
Abstract: The analysis of magnetic circuit of shaded pole induction motor (SPM), for basic micro - motor type 925 powered 3W, was conducted. The magnetic shunt as well as number and location of the compact laps are the influencing on electromagnetic parameters SPM elements, making up the auxiliary starting winding of motor. It the row of field calculations was executed from utilization the software OPERA 2d for different constructions of magnetic circuit of motor, and the different number of laps (thirteen the computational models). The simplest construction, and the simultaneously cheapest solution are then magnetic shunt is executed as prolongation of stator poles from one compact lap on pole. The realization of shunt made from the same electrotechnical sheet, what the whole core of motor is profitable technologically, however to reach hard near this the satisfactory electromagnetic parameters. The base of comparison of parameters row studied models establish the optimum solution of magnetic circuit of motor, the largest value of flux density in air gap and also the largest starting moment of motor was obtained.

Abstract: The matter in the article is the effect of practical experiences based on the engineering ground in the sphere of commissioning of technological applications of drive systems used in crane devices. The work introduces the rules of theoretical and practical realisation of the steering algorithm with torque control of a cage induction motor supplied from a frequency converter with an indirect DC link. The considerations concern the work of a drive arrangement for vector control steering algorithm for both cases: stopped and free running drive shaft of the motor with the utilisation of a speed sensor. Accomplishment of the procedures given above is essential for the realisation of industrial applications, in which the motors cooperate with brakes, slow down mechanisms or it is necessary to obtain initial torque or preliminary tension.

Abstract: Owing to a great variety of industrial electro-machine systems, it becomes more and more crucial to assess correctly electro-machine systems offered by their suppliers. It has been proved in this paper that by assessing systems offered to them exclusively on the basis of bivalent rules, purchasers are likely to incur economical losses. It is essential to apply elements of fuzzy (or multivalent) logics while performing such on assessment. With this purpose the notion of Hamming distance, applied in the theory of mathematical sets has been used in the easiest possible way. The Hamming distance, which defines an agreed distance between two sets of certain quantities, turned out to be useful for proposing a way of assessment of offered electro-machine systems. Considering same characteristics of electro-machine systems as quantities
included in sets defined by a Hamming distance a theoretical basis of such an assessment can be obtained. The paper presents a simple and interesting geometric interpretation of the abovementioned solutions. It also reveals a method of assessment and reciprocal comparison of offered electro-machine systems.

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USZKODZENIA ŁOŻYSK W SILNIKACH INDUKCYJNYCH UŻYTYCH W ORGANACH URABIAJĄCYCH KOMBAJNÓW GÓRNICZYCH

BEARINGS FAULTS OF INDUCTION MOTORS FOR MINING ELEMENTS OF HEADING MACHINE

Abstract: The paper presents research results dealing with bearing faults of high power induction motors. In the chapter 2 are presented simulation results, as an introduction to laboratory measurements. The harmonic analysis of the stator winding phase currents are shown in chapter 3. In chapter 4 are presented the causes of bearing currents forming during motor direct startup. The figure 3 shows the graphical presentation of the bearing currents forming issue. In chapter 5 measurement results are discussed. Waveforms of shaft currents and voltages, and their Fourier transforms are shown in Fig. 5, 6 and 7. Equivalent circuit diagram for bearing current flow is presented in chapter 6, Fig. 9. Equivalent circuit diagram for bearing current flow is presented in chapter 6, Fig. 9. Conclusions drawn from laboratory researches are presented in chapter 8.

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THE ELECTRIC PROPERTIES OF CURED MICA-GLASS COMPOSITES

WŁAŚCIWOŚCI DIELEKTRYKÓW OPARTYCH NA KOMPONENTACH ŻYWICA/MIKA/SZKŁO

Abstract: The curing of Resin-rich composites materials is an important part of technology of electrical rotating machines main wall insulation manufacturing. The using of optimal curing temperature increases the service reliability of insulating system as well as the whole electrical machine. The diagnostics of changing properties during the curing and the estimation of the optimal curing temperature are thus important components at the manufacturing of insulating system of electrical machines. The paper describes the behaviour of diagnostic parameter tan δ of cured mica-composites in dependence on curing temperature.

The studied material consists of two different three-layer mica composites, which are normally used for the manufacture of main wall insulation in electrical rotating machines. The basic components of the composites are: mica paper, epoxy-novolac resin and glass fabric. The particular variants of composites differ each from other in the type of curing agent. The specimens were cured over six different temperatures in the range from 130 to 180 °C. The main diagnostic parameter tan δ was measured online during the curing (curing characteristics) and after the curing process. The temperature dependence of tan δ was measured after the isothermal curing.

An analysis of the results allows us to determine the optimal curing temperature where the value of tan δ of the cured system is the lowest of all and the properties of temperature dependence of tan δ are the most suitable.

The magnitude tan δ gives very good information capability about materials during their curing and enables to determine the optimal curing temperature. The tan δ is also able to determine possible undercuring of the insulation, which occurs at lower curing temperatures.
POSSIBILITY OF ROTOR ECCENTRICITY DETECTION IN HARMONIC SPECTRUM OF STATOR CURRENTS OF SQUIRREL-CAGE INDUCTION MOTOR

Abstract: Asymmetry of induction motor, as eccentricity or fracture of bars or end-ring segments of a cage has an effect on harmonic spectrum of stator currents. In this paper I'm going to present possibility of rotor eccentricity detection in harmonic spectrum of stator currents or in symmetric component harmonic spectrums of stator currents of squirrel-cage induction motor. Calculation was made for symmetrical supply. Dynamical model of this machine calculates harmonics of stator, rotor and stator-rotor inductances accounting for only global saturation of the air-gap region. The model considered various rotational speeds of the rotor.

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INFLUENCE OF BAR DAMAGE LEVEL ON SYMMETRIC COMPONENTS HARMONIC SPECTRUM OF STATOR CURRENTS OF INDUCTION MOTORS – PART 2

Abstract: Asymmetry of induction motor, as eccentricity or fracture of bars or end-ring segments of a cage has an effect on harmonic spectrum of stator currents. In this paper I'm going to present comparison of symmetric component harmonic spectrums of induction machine stator currents with harmonic spectrums stator currents. I'm going to answer a question: can I use symmetric component harmonic spectrums of stator currents in diagnostics of induction machines. Calculation was made for nonsymmetrical supply. Dynamical model of this machine calculates harmonics of stator, rotor and stator-rotor inductances accounting for only global saturation of the air-gap region. The model considered various rotational speeds of the rotor.

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INFLUENCE OF STRUCTURE OF THERMAL EQUIVALENT DIAGRAM MAKE USE IN OBSERVER FOR RESISTANCE CHANGE IN INDUCTION MOTOR TO SPEED ESTIMATION

Abstract: The paper presents influence of structure the thermal equivalent diagram method for identification of stator and squirrel cage windings resistance thermal increases of the induction motor. A method for obtaining the change of induction motor speed caused by increase of windings temperature in load and overload state is presented, bared on stator and rotor windings resistance thermal increase. Author shortly presents the structure diagrams, which was used to identification stator and rotor resistance, and possibility of the block diagrams of rotor speed estimator are also presented. The estimator provides compensation thermal changes of the resistance windings – stator and rotor. Values of these resistances are used to improve precision of real time rotor speed calculation. The differences between identification resistances, obtained from different structures of thermal equivalent diagram are presented Comparison of the induction motor windings average temperature obtained from laboratory measurements, and from computer simulation in transient state was preformed.
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WPŁYW TEMPERATURY PRACY NA WŁAŚCIWOŚCI MAGNETYCZNE DIELEKTROMAGNETYKÓW

INFLUENCE OF WORKING TEMPERATURE ON MAGNETIC PROPERTIES OF DIELECTROMAGNETICS

Abstract: Magnetic powder composites find ever-wider use as active magnetic materials for magnetic cores of electric devices. Special interest is focused on dielectromagnetics. They are powder composites made from soft magnetic powder with an admixture of dielectric in the form of resins, which both bind and isolate the soft magnetic particles. The properties of manufactured dielectromagnetics and their constancy over time is one of the main factors, which determine the use of these materials. When the factors are examined and understood, it will become possible to design magnetic cores in such a way that the predictable changes in their properties will not disqualify the electric devices in the course of their service. In this paper changes in the magnetic properties of dielectromagnetics caused by working temperature are described. The magnetic properties of dielectromagnetics of the specimens were tested after they were stored one year in ambient conditions at a constant temperature of 100°C and (comparative series) at a constant temperature of 21°C and a constant humidity of 50%. The research has shown that the effect of working temperature on the magnetic properties of the tested dielectromagnetics is small and profitable. This is a proof of the high quality of the soft magnetic powder used whose properties remain stable over temperature.

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ROZKŁAD TEMPERATURY W PRĘCIE UZWOJENIA STOJANA TURBOGENERATORA

TEMPERATURE DISTRIBUTION OF TURBOGENERATOR STATOR WINDING BAR

Abstract: This paper present the mathematical model of thermal spread within stator winding bar in active part as well as the result of the calculation carried out by using this model. This model was created to take advantage of the heat diagram method. It was necessary to split winding bar into parts, inside which temperature is constant. In this way the substitute heat diagram has been obtained according to rules of electrical diagram. The results presented by this paper are applied to two cases of phase distribution inside the calculated slot. First case, the top and bottom bar has the same phase inside slot (slot number 1), for which temperature distribution is computed. Second case, bars belong to different phase (slot number 9). The computations were made for selected type of turbogenerator with indirectly cooled system and radial ventilation ducts. On the basis of running test result of this machine, the thermal model verification was carried out. The calculated temperature of spacer was checked with measurements.

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WPŁYW ZAMKNIĘCIA ŻŁOBKÓW STOJANA KLINAMI MAGNETYCZNYMI NA PARAMETRY SILNIKA PRACUJĄCEGO W CIEKŁYM AZOCIE

THE INFLUENCE OF STATOR SLOT CLOSURE WITH MAGNETIC WEDGES ON PARAMETERS OF A CRIOGENIC MOTOR

Abstract: This paper presents the influence of stator slot closure with magnetic wedge on different magnetic permeabilities in a motor designed specifically for cryogenic application. Calculation results of are obtained by simulation research on the
basis of finite element analysis conducted using Flux2D computer program. Basing on the obtained results, it was found that the application of a magnetic wedge in cryogenic motor causes decreases of both the electrical current drawn and electromagnetic torque. Simultaneously, the magnetic flux in air-gap is more uniformly distributed when compared with a typical motor. As a consequence, the values of current harmonics of the motor also decrease.

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WPŁYW KLINÓW MAGNETYCZNYCH ZAMYKAJĄCYCH ŻŁOBKI STOJANNA NA SKŁADOWE HARMONICZNE INDUKCJI W SZCZELINIE POWIETRZNEJ SILNIKA INDUKCYJNEGO

INFLUENCE OF THE MAGNETIC WEDGES CLOSING THE STATOR SLOTS ON THE AIR-GAP FLUX DENSITY HARMONICS IN THE INDUCTION MOTOR

Abstract: The problem of acoustic or audible noise, as often referred to, in electric machines is partly magnetic, partly mechanical and partly aerodynamic. The so called magnetic noise is the part of acoustic noise that originates from the action of magnetic forces in the magnetic circuit of an electrical machine. Magnetic noise comes into effect when the magnetic field is existed. The analysis influence of the magnetic wedges closing the stator slots on the air-gap flux density in the induction motors was conducted by means of a model being a representation of a fragment of the motor’s circuit. As a subject of analysis, the area being a cross section in plane transversal to motor’s axis and covering stator slot and rotor slot together with neighboring teeth has been adopted. The performed calculations proved that in the model, relative position of slots with respect to each other results in changes of distribution the air-gap flux density. The magnetic wedge closing the stator slot influence on the amplitude and phase value all the air-gap flux density harmonics. In this article there are shown the calculate resultates this dependence.

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BADANIE WPŁYWU GRUBOŚCI SZCZELINY POWIETRZNEJ NA WŁAŚCIWOŚCI SILNIKÓW RELUKTANCYJNYCH PRZEŁĄCZALNYCH W OPARCIU O OBLICZENIA POŁOWE

THE INVESTIGATION OF THE INFLUENCE OF THE THICKNESS OF THE AIR-GAP ON THE PROPRIETY OF SWITCHED RELUCTANCE MOTORS BASING ON FIELD CALCULATIONS

Abstract: The paper presents the influence of the thickness of the air gap on basic proprieties of switched reluctance motors. Based on field calculations using finite elements method for selecting structure of SRM there are described characteristics of electromagnetic torque, flux linkage and self inductance depends on flowing current and angle of rotor. There is described the influence of thickness of the air gap on average electromagnetic torque generated by motor and ratio between aligned inductance and unaligned inductance (L_a/L_u). There are show selected waveforms of current and electromagnetic torque for selected thickness of air gap of SRM model. There are presented the conclusions.

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ANALIZA WPŁYWU SZEROKOŚCI BIEGUNÓW STOJANA I ŻEŃBÓW WRJNIKA NA PARAMETRY EKSPLOATACYJNE SILNIKÓW RELUKTANCYJNYCH PRZEŁĄCZALNYCH NA BAZIE OBLICZEŃ POŁOWYCH
THE ANALYSIS OF THE INFLUENCE OF THE WIDTH OF STATOR AND ROTOR POLES ON EXPLOITIVE PARAMETERS OF SWITCHED RELUCTANCE MOTORS ON THE BASIS OF FIELD CALCULATIONS

Abstract: The paper presents the influence of stator and rotor pole arcs on exploitive parameters of switched reluctance motors. Based on the field calculations for three structures of SRM (6/4, 8/6, 12/8) calculated characteristics of average electromagnetic torque $T_{eav}$ dependent on value of stator pole arc $\beta_s$ and rotor pole arc $\beta_r$. There are shown characteristics of described motors models and conclusions.

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LABORATORY STAND FOR TESTING DC MOTORS WITH A COMPUTERIZED MEASURING SYSTEM

Abstract: Wide availability of high-class computer equipment, software, measurement cards, converters as well as of devices cooperating with data acquisition systems makes possible to build technologically advanced, modern measuring systems. Such systems are applied to the testing of electrical machines more and more frequently. Due to the application of a graphical integrated program environment it is possible to intuitively create applications to acquire, analyze and present measurement data at the user graphical interface.

The article presents a laboratory stand for testing of dc motors that is equipped with a modern measuring system. It includes the following elements: a PC, measurement card of the PCL-818L type, converters of current, voltage, rotational speed, and force as well as a software elaborated on the basis of the DasyLab program and adapted to determine selected characteristics of a dc motor.

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EXAMPLE APPLICATION OF AN OPTOELECTRONIC ANALYZER OF SPARKING TO TEST DIRECT-CURRENT MACHINE COMMUTATION

Abstract: The paper presents example application of an optoelectronic analyzer of sparking to test commutation on a physical model of a typical d.c. machine. Prior to the sparking measurements mechanical testing of the commutator geometry taking into account irregularities of each individual bar has been performed. Next, commutation testing has been performed with the application of the proposed algorithms for sparking evaluation. Testing of commutation properties of a d.c. machine has been performed at feeding conditions that simulated feeding by a static frequency changer. Results of measurements and calculations have been presented in graphical and numerical forms.

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ASPECTS OF ELECTRICAL MACHINES AND PHOTOVOLTAIC GENERATORS COOPERATION
Abstract: The most important aspects, determining the operation possibilities of different kind electrical machines in photovoltaic (PV) driving systems, have been discussed in this article. In such a system a PV generator, directly converting sunlight energy into electrical energy, is the basic energy source for electrical machine. Technically, and presently often economically, reasonable examples of PV driving systems applications, such as driving of pumps, compressors, fans and feeders, have been presented below. The basic properties of PV generators, as low-voltage DC-current energy sources with significantly of fate changing parameters, have been short reminded. The basic features of different kind structures of PV driving systems (grid-connected, stand-alone with accumulators, stand-alone without electrical buffer energy sources) have been presented in brief. Detailed description and analysis of different kind electrical machines properties at an angle of possibilities of their operation in PV driving systems has been done. The instructions for selection of energoelectrical energy converters used between PV generators and electrical machines have been also presented. The application of these converters is necessary, because direct connection of the machine to PV generator is either impossible, or in practice not profitable. The article issues will be much more important in Poland in near future, because of permanent, intensive growth of PV market in the wide world (tens percents yearly) for the last several years. This fact should cause analogous state of affairs in Poland soon.

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PRACTICAL IMPLEMENTATION OF 1 – PHASE AC DRIVE SYSTEMS SUPPLIED BY PV ARRAYS

Abstract: The possibility of constructing autonomic PV low power generators used for electric driving systems feeding emerged within last few years. These systems, usually 1-phase AC driving systems, may be used in certain household advices. The amount of energy produced by these unconventional energy sources depends on current weather conditions. The paper describes a new method of maximum power point tracking for photovoltaic generator of 1-phase AC drive system without a buffer energy source. The specific quality of this method is assuring the maximum power working point of the generator in an indirect way - by maximization of motor input power. This method makes maximum power point tracking independent of generator cells temperature and insolation, and of any changes of generator output characteristic (voltage-current) curves caused by light cells aging and shading of some cells, when shaded with snow or dirt. Chosen results of laboratory tests are presented in figures.

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PRACTICAL IMPLEMENTATION OF DC DRIVE SYSTEMS SUPPLIED BY PV ARRAYS

Abstract: The possibility of autonomic PV low power generators constructing used for electric driving systems feeding has emerged within last few years. The amount of energy produced by these unconventional energy sources depends on current weather conditions. The paper describes a new method of maximum power point tracking for photovoltaic generator feeding magnetoelectric DC-motor in stand-alone photovoltaic drive system without a buffer energy source. The specific quality of this method is assuring the maximum power working point of the generator in an indirect way - by maximization of motor input power. This method makes maximum power point tracking independent of generator cells temperature and insolation, and of any changes of generator output characteristic (voltage-current) curves caused by light cells aging and shading of some cells, when shaded with snow or dirt. The chosen results of laboratory are been presented in fig.
Abstract: The article describe start of the AFC drive system with silicon controlled rectifier CST-30. The CST can realize both – soft and hard start all of AFC motors without workload. For energetic system protection each of motor start is realized with time delay. Until the last started motor reaches nominal rotation speed, the CST drive system is supplied with pressure medium. The pressure is increased until torque can exceed AFC drag.