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WPLYW ZASILANIA NAPIĘCIEM ODKSZTAŁCONYM NA WIDMO PRĄDÓW STOJANA SILNIKÓW KLATKOWYCH – CZĘŚĆ 2

INFLUENCE OF NON-SINUSOIDAL VOLTAGE SUPPLY ON HARMONIC SPECTRUM OF STATOR CURRENTS OF INDUCTION MACHINES – PART 2

Abstract: In this time more induction motors are supplying by non-sinusoidal voltage. In diagnostics of induction motors we use harmonics of stator current $(1\pm 2s)f_0$ as diagnostic signals. In this paper I'm going to answer a question: can I find any frequencies in spectrum of non-sinusoidal voltage which disturb $(1\pm 2s)f_0$ signals? I'm going to present results of calculations and measurements of stator current spectrums for squirrel-cage induction motors supplied by non-sinusoidal voltage in no-load and load operations, for good motor and motor with damages (broken bars in cage, static and dynamic eccentricity). Calculations were made for a 7.5 kW squirrel-cage induction motor. 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 variations of rotational speed of the rotor.

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STANOWISKO DO BADAŃ SILNIKÓW RELUKTANCYJNYCH PRZEŁĄCZALNYCH Z ZASTOSOWANIEM PROCESORA SYGNAŁOWEGO

EXPERIMENTAL TEST STAND OF SWITCHED RELUCTANCE MOTORS USING DIGITAL SIGNAL PROCESSOR

Abstract: The paper presents description of laboratory stand to examined of switched reluctance motors which worked out in Technical University of Technology in Rzeszow. The laboratory stand is based on the PC computer and dSpace DS1104 card with ControlDesk program and Matlab/Simulink environment. The test stand makes possible among other things examine of advanced control methods of SRM and determined flux characteristics. There are also presented the technical characteristic of laboratory stand. Results of laboratory tests are enclosed. Conclusion is presented.

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ANALIZA STANÓW AWARYJNYCH SILNIKA RELUKTANCYJNEGO PRZEŁĄCZALNEGO PRACUJĄCEGO W ZAKRESIE STAŁEGO MOMENTU

ANALYSIS OF SWITCHED RELUCTANCE MOTOR FAULTS CONDUCTIONS OPERATED IN CONSTANT TORQUE REGION

Abstract: The paper shows of the run of switched reluctance motor (SRM) in electrical faults conductions. There is discussed classification of causes of faults conductions. There are presented selected cases of faults conductions. An analysis of switched reluctance motor operation in constant torque region performance is done on the basis of results from computer simulation. There are discussed analysis a contents of harmonics selected waveforms. Results of laboratory tests are enclosed. Conclusion is presented.

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SIŁY ELEKTROMAGNETYCZNE DZIAŁAJĄCE NA KLINY MAGNETYCZNE ZAMYKAJĄCE ŻŁOBKI STOJANA

ELECTROMAGNETIC FORCES ACTING ON MAGNETIC WEDGES CLOSING STATOR SLOTS

Abstract: In sustained use of high-voltage electric motors, when magnetic wedges are used to close the slots, loosening and slipping out of the wedges can be observed. This can lead to destruction of the motor as a result of seizure of the rotor and deformations of stator windings caused by dynamic action of current in absence of rigid closing of slots. In the course of inspection of dismantled wedges, one can observe evident losses of wedge material, in the pack part, as well as absence of wedges in some of radial ventilation channels. This is an effect of forces acting on magnetic material in electromagnetic field. The analysis of forces acting on the magnetic wedge 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 respects to each other results in changes of both value and direction of the resulting force reduced to the geometric centre of the wedge.

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ZASTOSOWANIE SIECI NEURONOWEJ DO BADANIA PRZEBIEGÓW CZASOWYCH ROZRUCHU MASZYNY INDUKCYJNEJ

APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN CALCULATIONS BASED ON TIME DOMAIN IN INDUCTION MACHINES

Abstract: The paper presents application of artificial neural network in induction machine speed determination making use of current and voltage waveforms. Also speed values in past sequences are given to the network input, to secure recurrent capability of the standard static network. Training and testing was made on real 3kW-induction machine. In the training set we have data from a few starting cycles. Final results are quite good and could be a base for further investigations. The advantage of this model is that the speed calculation based on the measurement of the real values of current and voltage. In practical, speed measurement is more difficult than current and voltage measurement, so someone may consider using this model instead of speed measurement.

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WPLYW PSEUDOSKOSU BIEGUNÓW WIRNIKA I SKOSU ŻŁOBKÓW STOJANA NA PULSACJE MOMENTU I SEM W BEZSZCZOTKOWYCH SILNIKACH Z MAGNESAMI TRWAŁYMI

INFLUENCE OF SHIFTED MAGNET BLOCKS AND SKEWED SLOTS ON TORQUE PULSATION AND BACK-EMF IN BRUSHLESS PERMANENT MAGNET MOTORS

Abstract: The influence of the changes in construction of stator and rotor cores on cogging torque and back EMF was investigated. Computations and measurements were made for several different constructions of a stator and a rotor. The first one of stators was conventional, while the second one had the skewed slots. The rotor construction had possibility of shifting magnet blocks within the slot pitch range. The finite element method and Opera-2d software from Vector Fields Ltd were used for computations. The measurements of the cogging torque were compared with the results of the computations.

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NIEINWAZYJNA DIAGNOSTYKA WIRNIKA MASZYNY ASYNCHRONICZNEJ

NONINVASIVE DIAGNOSTICS OF ROTOR IN ASYNCHRONOUS MOTOR

Abstract: Paper presents the non-invasive method of complex estimation of rotor state for cage induction motors, based on analysis of stator winding currents. FFT amplitude spectral analysis is usually applied for the stator current in chosen phase. Such approach is correct if the estimation concerns only the cases electrical cage asymmetry or dynamic eccentricity. The simultaneous appearance air-gap and cage asymmetry or static eccentricity and asymmetry of supply voltage makes correction quantitative analyze impossible. To minimize these difficulties the increase of the numbers of diagnostic signals (measure currents in three phases) and better use of information from diagnostic signals (use phase spectrum of current) is necessary. This paper deal with this problem. The stator phase currents in steady state are calculated by a harmonic balance method.

The results show that there are important differences in the amplitude and phase spectrum of stator currents, which can be utilized for rotor condition monitoring and diagnostic purposes.

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OBLICZENIA BOCZNIKA MAGNETYCZNEGO SILNIKA INDUKCYJNEGO Z FAZĄ ZWARTĄ

THE CALCULATION OF THE MAGNETIC SHUNT OF THE INDUCTION MOTOR WITH COMPACT PHASE

Abstract: Shaded-pole induction motor is built as a normal induction engine with an auxiliary short-circuited winding. It is working similarly to a double-phase engine. Thanks to many advantages it is widespread. These advantages are, among other things, simple construction and low price. Due to the small dimensions there are some technological problems connected with the production of an engine, with very good technical parameters. Domestic engines are much inferior in comparison with foreign engines, which requires the need of optimization. A very important element during the optimization of an engine is to improve the shape of the magnetic circuit, especially the magnetic shunt, and at the same time to maintain the economy and technology effectiveness of the introduced changes. The shape of magnetic shunt has the decisive influence on the value of the electro-magnetic torque produced. Elongated shape of the shunt assures the penetration of the magnetic flux into the rotor in a definite bigger part of the rotor circuit, which gives rise of the torque value.

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ENERGETYCZNE ASPEKTY ZASTOSOWANIA UKŁADÓW MIĘKKIEGO ROZRUCHU I HAMOWANIA SILNIKÓW INDUKCYJNYCH KLATKOWYCH

THE ENERGETIC ASPECTS OF THE SOFT STARTERS APPLICATION FOR SQUIRREL – CAGE INDUCTION MOTORS

Abstract: The aim of this paper is to elucidate the energetic aspects when soft starters are used for starting and braking the squirrel cage induction motors with constant load. The technique for engineering calculations of induction motor energy losses in transients when the applied voltage changes in accordance with linear and exponential laws is given in this work. On the basis of energy losses comparison one can reveal pros and cons the soft starter application for the definite electrical drive. The theory is illustrated with curves which show energy losses dependences on transient time for a concrete induction motor.

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WPLYW ZJAWISK STARZENIOWYCH NA STRATNOŚĆ DIELEKTROMAGNETYKÓW

INFLUENCE OF MAGNETIC AGEING PHENOMENA ON LOSSINESS OF DIELECTROMAGNETICS

Abstract: Lately magnetic powder composites find ever wider use as active magnetic materials for magnetic cores of electric devices. Because of their proprieties and manufacturing technology, dielectromagnetics attract a great interest. They are powder composites made from soft magnetic powder with an admixture of, among others, 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 as well as the influence of the operating conditions (e.g. temperature) or the medium (e.g. humidity) on them are 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 lossiness of dielectromagnetics, made of soft magnetic powder ASC 100.29 with an admixture of epoxy resin Epidian 101 in the amount of 0.1% and 0.2% by weight, caused by ageing are described.

The lossiness of dielectromagnetics of the specimens were tested twice: immediately after they were made ($t=0$) and one year later ($t=365$). The dielectromagnetics were stored in ambient conditions at a constant temperature of 21°C and a constant humidity of 50%.

The research has shown that the effect of ageing phenomena on the lossiness of the tested dielectromagnetics is small, about 3%. This is a proof of the high quality of the soft magnetic powder used whose properties remain stable over time.

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ZASTOSOWANIE NANOKRYSTALICZNYCH MAGNESÓW Nd-Fe-B W SILNIKU SKOKOWYM

APPLICATION OF NANOCRYSTALLINE Nd-Fe-B MAGNETS IN STEPPER MOTOR

Abstract: Magnetic properties of nanocrystalline magnets are determined not only by their composition but mainly by the microstructure. Nanocrystalline microstructure can be produced in RE-M (rare earth - transition metal) magnets such as NdFeB and SmFeN. The magnetic properties of such magnets are controlled by magnetic exchange interactions. The interactions lead to enhanced remanence, which causes that isotropic materials achieve properties close to those presented by the anisotropic magnets. Nanocrystalline magnets can be produced in a form of powders or ribbons, which are further consolidated to a fully dense material. These processes can not lead to grain coarsening. Thus they are generally based on resin bonding, however shock pressing, hot pressing and pulsed sintering can also be applied. An attempt of replacing Alnico magnets, in a FA-15 stepper motor produced by MIKROMA from Września, by nanocrystalline NdFeB bonded magnets, having different Nd contents and properties, has been undertaken. The studies of basic motor properties such as: one phase current, inductance of phase, holding torque, start-stop frequency, cut-off frequency and cut-of torque at frequency 400Hz, have shown that that they fulfill standards defined for motors with Alnico magnets, and in many cases exceed them. With application of the $Nd_{12}Fe_{82}B_6$ magnets the holding torque and start-stop frequency increased by 28% and 41%, respectively, when compared with Alnico magnets. In the case of application of commercial MQP-0 powder, produced by Magnequench, the holding torque was higher by 55% and the start-stop frequency by 31%.

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OBLICZANIE PRZEBIEGÓW CZASOWYCH NAPIĘĆ I PRĄDÓW WYJŚCIOWYCH GENERATORÓW SYNCHRONICZNYCH WZBUDZANYCH MAGNESAMI TRWAŁYMI PRACUJĄCYCH SAMOTNIE POD OBCIĄŻENIEM

CALCULATION OF THE VOLTAGE AND CURRENT WAVES ON THE PERMANENT MAGNET SYNCHRONOUS GENERATOR OUTPUT TERMINALS DURING LOAD CONDITIONS

Abstract: This paper deals with the procedure of calculations of the voltage and current waves on the permanent magnet synchronous generator output terminals. It was assumed, that permanent magnet generator is working as a stand-alone generator loaded with load type R, RL, RC, RLC or load with rectifier included in electric circuit. Procedure is based on the time-stepped finite element analysis method. The successive steps of modeling and simulation of the loaded, stand-alone permanent magnet generator in the time-stepped finite element method are described. Examples of calculation results obtained using this procedure are shown in Fig. 3 ÷ 10. Calculations using this procedure are very useful for accurate prediction of the voltage drop on the output terminals during the operation of stand-alone permanent magnet synchronous generator.

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STEROWANIE CZĘSTOTLIWOŚCIOWE PRĘDKOŚCIĄ KĄTOWĄ SILNIKA INDUKCYJNEGO KLATKOWEGO Z ZASTOSOWANIEM PĘTLI SYNCHRONIZACJI FAZOWEJ

SPEED CONTROL SYSTEM OF SQUIRREL-CAGE INDUCTION MOTOR BASED ON PLL TECHNIQUE

Abstract: The paper presents the application of PLL technique in AC drive system. In most standard speed control systems the shaft velocity is measured using tachogenerator and is given in the form of DC voltage. This voltage proportional to shaft velocity is compared with the voltage given at the input of the speed controller. Tachogenerator must meet high requirements as linear speed-voltage characteristics, ability of detection the velocity direction, negligible temperature errors and acceptable pulsations of output voltage. Its accuracy depends on magnetic flux (time-limited stability of permanent magnets - magnetic aging). Besides tachogenerator generates no signal when run at very low speed and produces commutation noises. The core of using PLL technique is the conversion of input and output velocity signals of standard speed control from voltages to proportional frequency signals. The wanted input value of velocity is given to the input of speed control system not as a voltage signal but as a frequency signal. The shaft velocity is measured using resolver that gives sine signal of frequency proportional to the actual shaft speed. This signal is next synchronized with input frequency trough the control process. Then the angular velocity of the motor shaft meets perfectly the input velocity.

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NIEZALEŻNE UKŁADY CHŁODZENIA SILNIKÓW ELEKTRYCZNYCH

INDEPENDENT COOLING SYSTEMS OF ELECTRICAL MOTORS

Abstract: The paper presents design schemes of independent cooling systems for electric motors usually employed cooling systems are dependent (where cooling fan is installed on the shaft of motor) have low efficiency and high level of noise. There is also impossible to adjust flow condition to the external conditions (high temperature in the summer and low in winter). The mean advantages due to the independent cooling systems are: possibility to maintain of nearly constant thermal conditions of the electric motor, low level of noise and high efficiency of the system. The modern electric motors should be equipped with independent cooling systems.

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ZNACZENIE DŁAWIKÓW W UKŁADACH NAPĘDOWYCH Z PRZEMIENNIKAMI CZĘSTOTLIWOŚCI

THE IMPORTANCE OF FEEDER REACTORS USED IN THE ELECTRIC DRIVES EQUIPPED WITH FREQUENCY CONVERTERS

Abstract: The paper deals with three different configurations of connection between the electric drive composed of an asynchronous motor with frequency converter type DTC, PWM and the electric grid with frequency 50Hz. The main difference between three investigated connection configurations is the way in which the feeder reactors are connected to the drive system equipped with frequency converter, and as a consequence, the different impacts of these connection configurations on the operating parameters of the squirrel-cage induction motors. To describe above problem, the main operating parameters of monitored induction motors regarding the insulation indexes and the changes of phase resistances were determined. The insulation indexes of monitored motors were calculated using the measured waves of the phase voltages and phase currents of these motors. As a measurement method, the discrete recording of voltage and current waves by the use of PC computer with "DASY Lab" software installed was used.

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CELOWE ZWIĘKSZANIE MOMENTU ZACZEPOWEGO W BEZSZCZOTKOWYM SILNIKU PRĄDU STAŁEGO

INTENTIONAL INCREASE OF THE COGGING TORQUE IN DC BRUSHLESS MOTOR

Abstract: In this paper structure of the DC brushless motor with large cogging torque has been presented. Its stator is made of steel sheets used in the small one-phase squirrel cage motor SEMkf-63-4C2/15. Eight-pole, three-phase winding with its bands connecting in star manner is placed in the stator of this motor. The rotor of this motor is a steel cylinder with eight-pole magnet made of N38 material (1,2T and 950 kA/m) glued on its surface. In order to maximalize cogging torque, the stator slots were placed parallelly towards pole magnet of rotor. Reflective opto-couplers were used to determine the position of rotor relative to stator. The cogging torque of this motor is equal to 2,16 Nm. Thanks to application of a typical steel sheets of stator and chassis, the motor characterizes the low price.

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PROBLEMY REGULACJI MOMENTU I STRUMIENIA METODĄ DTC WYSTĘPUJĄCE PODCZAS PRACY SILNIKA PRZY NISKICH PRĘDKOŚCIACH KĄTOWYCH

PROBLEMS OF TORQUE AND FLUX CONTROL OCCURRING WITH A LOW SPEED OF AC MOTOR CONTROLLED BY DTC METHOD

Abstract: Direct torque control method proposed by Takahasi and Noguchi in 1985 in spite of its disadvantages (flux vector hexagonal in shape and distorted current for small motor speed) is competitive to the flux oriented methods of control (FOC). Methods of the current controlled AC motor investigations and their results presented earlier by author was applied to DTC method control analyze. Although in DTC method the current components are not controlled directly, the torque and flux control phenomenon is easy explained by the current components i_{sq} , i_{sd} changes. DTC method operation analysis to explain the flux and current distortion for the small speed of motor operation is discussed in the article. As results this

observations the method DTC scheme modification is proposed. The modified DTC method is free from the conventional DTC method disadvantages. The dynamical properties of new method are similar to conventional DTC method. It is important that in the modified method the conventional switching table is used. Correctness of new method is confirmed by laboratory investigations.

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WERYFIKACJA MODELU OBLICZENIOWEGO SILNIKA KLATKOWEGO POMIARAMI STATYCZNYCH I DYNAMICZNYCH STANÓW PRACY

VERIFICATION OF A SQUIRREL CAGE MOTOR CALCULATION MODEL BY MEASUREMENTS OF STATIC AND DYNAMIC WORK STATES

Abstract: The work presented calculation and measurement results of a small power (1.5 kW) squirrel cage motor, thus verifying used for calculation two-dimensional circuit- field motor model. Using the prepared model, calculations of static (no load, load and locked rotor) characteristic as well as dynamic (start up to no load) were compiled. Convergence of calculated and measured characteristics results varies for different motor work states. It is a result of an employment of approximations in two-dimensional circuit-field motor model as well as of varying measurement conditions. Assumed for calculations speed and temperature stability cannot be maintained in the measuring conditions. The calculating model assumption of constant parameters of stator winding frontal connections and squirrel cage ring, causes that such diverse motor work states as no load and locked rotor, could not be precisely calculated at the same time. None the less good consistence of calculated and measured results, for the full motor operating range, is obtained by assumption of mean values of inductivity and frontal connection . It may be therefore accepted, that the described model is useful in evaluation of events occurring in different states of motor operation.

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ANALIZA WRAŻLIWOŚCI STRUKTUR STEROWANIA UKŁADU NAPĘDOWEGO Z POŁĄCZENIEM SPRĘŻYSTYM NA ZMIANĘ PARAMETRÓW MECHANICZNYCH

SENSITIVITY ANALYSIS OF TWO-MASS SYSTEM CONTROL STRUCTURES FOR MECHANICAL PARAMETER CHANGES

Abstract: In the paper the analytical design procedure of a speed control system with PI controller and different additional feedbacks for a drive with an elastic joint is shown. The comparative analysis based on the location of closed-loop system poles is presented. The analytical equations, which ensure required damping coefficient of the drive system are given. The sensitivity of the considered control structures for mechanical parameter changes was checked. The dynamic behavior of considered control structures with different speed controllers have been examined using computer simulations and experimental tests.

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ZASTOSOWANIE NEURONOWEGO DETEKTORA DO MONITOROWANIA I DIAGNOSTYKI WIRNIKÓW KLATKOWYCH SILNIKÓW INDUKCYJNYCH

APPLICATION OF NEURAL DETECTOR IN MONITORING AND DIAGNOSTICS OF ROTOR CAGE OF INDUCTION MACHINES

Abstract: This paper deals with problems concerning practical realization of neural detectors of rotor faults for induction motors. The design methodology for such neural detector was presented. Neural network was trained and tested using harmonics obtained from spectral analysis of the stator current and the stator current space vector modulus. The on-line operation of this neural detector in the real drive system was presented in the paper.

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ZASTOSOWANIE ANALIZY FALKOWEJ DO WYKRYWANIA USZKODZEŃ W UKŁADZIE NAPĘDOWYM Z SILNIKIEM INDUKCYJNYM

APPLICATION OF THE WAVELET TRANSFORM FOR FAULT DIAGNOSTICS OF INDUCTION MOTOR

Abstract: This paper presents an application of wavelet transform technique to induction motor analysis. Two motor faults were considered namely the rotor broken bars and the defect of bearing. In the first case the diagnostics procedure was based on stator current transients (in full-load and start-up conditions). The fault of the bearing was detected using vibration signal. As the wavelet base the Daubechies wavelet was selected and the wavelet coefficient was obtained using wavelet packet analysis. The energy eigenvalue of each frequency region was chosen as the criterion used to diagnose of motor condition. The laboratory set-up used in the research was briefly described.

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HAŁAS MAGNETYCZNY PRZYCZYNY WYSTĘPOWANIA, MOŻLIWOŚCI ZMNIEJSZENIA

MAGNETIC NOISE REASONS OF OCCURRENCE, POSSIBILITIES OF REDUCTION

Abstract: The total noise emitted from squirrel-cage motors has three basic types of origin sources: electromagnetical, mechanical and aerodynamical. The issues connected with electromagnetic noise were submitted to the detailed analyze. Electromagnetic noise in induction motors is caused by their construction and principle of operation. This fact causes that accurate recognition of reason and placement of source of the noise, makes possible the limitation of intensity of occurrence. The main reasons of occurrence of noise of electromagnetic origin are the radial forces acting on the surface of cores of stator and rotor in the vicinity of the air gap. They are the result of the electromagnetic field occurring in the air gap. This electromagnetic field changes along the magnetic circuit as a function of time. The analyze of distribution of magnetic induction in the air gap along the inhomogeneous magnetic circuit in case of slots of stator closed with magnetic and non-magnetic material, has shown the results of usage of magnetic materials and level of the generated noise.

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DESKRYPTORY TECHNIKI CAD SYMULACJI KOMPUTEROWEJ SYSTEMÓW ELEKTROMASZYNOWYCH Z ZASTOSOWANIEM ENERGOOSZCZĘDNYCH SILNIKÓW ELEKTRYCZNYCH - BADANIA, POMIARY, DIAGNOSTYKA I MONITORING

DESCRIPTORS OF TECHNIQUE CAD OF COMPUTER SIMULATION OF ELECTRICAL ENGINEER SYSTEMS WITH USE OF ENERGY-SAVING ELECTRIC ENGINES - INVESTIGATIONS, MEASUREMENTS, DIAGNOSTIC AND MONITORING

Abstract: At present technical engineering uses computer aid in simulate investigations. One from general uses of computers them use in simulate investigations is. Computer simulation is investigative method, state platform between theory and experiment. Often she carries also I will name computer experiment.

Electric engines use up during productive process over 56% of whole electric produced energy in country. Having accord to last datas waste this grows. Controlling process of steering electric energy, which it delivers itself driving arrangement it regulates itself rotatory speed and rotatory moment. Need of control of speeds and rotatory moment results from technological regards and economies of energy. Search of suitable models for elektromechanical systems joins with projecting of electric engines, exploational methods as well as prognostic solutions for present driving arrangements.

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DYNAMICZNE MODELE OBLICZENIOWE MASZYN INDUKCYJNYCH I ICH IDENTYFIKACJA

DYNAMIC MODELS OF INDUCTION MACHINES AND METHODS OF IDENTIFYING THEM

Abstract: This paper describes mathematical models of different types of induction motors: squirrel-cage, idle bar and models considering saturation of leakage inductances. A model differential equations has been formulated and a universal method estimation of the parameters of this model, on the basis of measured static characteristics or dynamic runs has been presented. Examples of simulation results based on these models have also been presented.

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PPZEGLĄD MASZYN ELEKTRYCZNYCH STOSOWANYCH W SYSTEMACH KOMPUTEROWYCH

A REVIEW OF ELECTRICAL MACHINES APPLIED IN COMPUTER SYSTEMS

Abstract: Each device applied in computer systems includes an electric motor, which is indispensable to ensure proper operation and convenient use as well as reliability of the whole system operation. There is a variety of electrical motors applied depending on the device type or operation requirements.

Usually, a motor is combined with electronic systems and microprocessors in one casing forming a new kind of a drive, where the motor is only a part - an energy converter of sometimes quite a considerable power. Technological advances and a development of computer systems make electrical motors their indispensable component.

The article presents a review of the most frequently applied electrical machines - their design, basic characteristics and operation.

Electrical machines that are the most frequently applied in computer systems are motors of the following types: stepper ones, commutator DC ones, synchronous (reluctance, hysteresis, permanent-magnet) ones. Advantages and disadvantages of a stepper motor have been discussed and design directives for that type of a motor have been given.

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WYBRANE ALGORYTMY REGULACJI NAPIĘCIA ZASTOSOWANE PRZY ENERGOOSZCZĘDNEJ PRACY SILNIKÓW INDUKCYJNYCH

SELECTED ALGORITHMS OF VOLTAGE CONTROL APPLIED AT ENERGY-SAVING OPERATION OF INDUCTION MOTORS

Abstract: Economic efficiency of a driving system depends on rated energy indicators of a motor. The article considers energy-saving operation possibilities for an induction motor at feeding voltage control. Factors that can enhance energy indicators, such as current input to the motor, power factor and efficiency, have been given. Motor load can vary within a wide range depending on the kind of its operation. Energy indicators can be enhanced by applying varied voltage depending on the load rate. Therefore, simultaneous change of voltage and load makes the motor operate at higher values of energy indicators, which decide over energy consumption. At rated load a motor has to be fed with rated voltage, while decreasing load should be accompanied by an adequate voltage reduction. Minimal voltage is required at open-circuit operation condition.

Voltage reduction brings about a decrease of voltage-dependent energy losses and an increase of power factor and efficiency, which leads to a reduced power input and consequently to saving of electrical energy. The article presents voltage control algorithms, which ensure maintaining energy indicators at an adequate predefined level. The indicators have been enhanced and energy savings have been calculated for various algorithms of voltage control.

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SYMULACJA PRZEBIEGU PRĄDÓW W ZEZWOJACH KOMUTUJĄCYCH PRZY ZASILANIU WYGŁADZONYM ORAZ PULSUJĄCYM PRĄDEM TWORNIKA

SIMULATION OF A CURRENT COURSE IN COMMUTATING COILS AT SMOOTHED AND PULSATING ARMATURE-CURRENT FEED

Abstract: The article presents simulation tests on the current course in a shorted coil of a direct-current -machine fed with a DC component and with a pulsating armature-current component. The tests have been performed at the following assumptions: brush width is greater than a segment pitch, a non-linear characteristic of the brush- commutator bar transition, moving- contact resistance being neglected, full magnetic symmetry of the machine, smoothed exciting current, constant self inductance and mutual inductance of armature coils in commutating circuits, rectangular induction distribution in the commutation zone, and ideal brush-to-commutator bar adhesion.

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WYBRANE PARAMETRY ELEKTRYCZNE DO OCENY REAKTORÓW PLAZMOCHEMICZNYCH

SELECTED ELECTRICAL PARAMETERS APPLIED TO THE EVALUATION OF PLASMA-CHEMICAL REACTORS

Abstract: A number of ozone applications, and especially of applications related to the environment protection (water and waste treatment, prevention of atmosphere pollutant emissions) constantly increases and causes substantial growth of demand for industrially produced ozone which involves a search for new ozone-generation methods, attempts to increase efficiency of already applied methods as well as elaborating of new improved designs of ozone-generating apparatus.

To arrive at a full and complex understanding of the ozone synthesis process it is valuable to study electrical characteristics of the reactor (ozonizer). Knowing those characteristics it is possible to evaluate the ozonizer operation and assess utilization degree of the driving electrical energy at optimal running of the physical-chemical process.

The article also includes results of investigations into various electrical parameters used to evaluate plasma-chemical reactors exemplified by an ozonizer with conducting packing.

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PORÓWNANIE WŁAŚCIWOŚCI ROZRUCHOWYCH SILNIKÓW INDUKCYJNYCH KLATKOWYCH Z WŁAŚCIWOŚCIAMI SILNIKÓW SYNCHRONICZNYCH RELUKTANCYJNYCH NA PODSTAWIE OBLICZEŃ POLOWYCH

COMPARISON OF STARTING PROPERTIES OF SQUIRREL - CAGE MOTORS WITH THOSE OF SYNCHRONOUS RELUCTANCE MOTORS BASING ON FIELD CALCULATIONS

Abstract: The paper presents the field circuit computation results of the squirrel cage motor and the reluctance motor manufactured on the basis of the squirrel cage motor sheets. The computations have been carried out for the motor reverse at the increased moment of inertia. Hence, the average characteristics of the electromagnetic torque allowing estimation of the motor starting properties have been obtained. For the squirrel cage motor the computation results of the field-circuit model have been compared with those for the circuit model in which higher space harmonics have been included.

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USZKODZENIA ŁOŻYSK TOCZNYCH SPOWODOWANE PRĄDAMI ŁOŻYSKOWYMI - BADANIA LABORATORYJNE

INVESTIGATIONS OF FAILURES OF ROLLING BEARINGS CAUSED BY BEARING CURRENTS

Abstract: Paper presents analysis and investigations of the influence of electric motors supply from frequency converter on the rolling bearings failures. Samples of bearing's failures are presented (Fig. 1). Substitute model of rolling bearing (Fig. 2) and process of nucleation of bearing currents (Fig. 3) are presented. Results of service life of rolling bearing after current pulses are shown on Fig. 4. Figure 5 shows topography of surface of rolling bearing, Figure 6 – state of bearing raceway after 250h of service life.

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WYZNACZENIE MOMENTU ELEKTROMAGNETYCZNEGO SILNIKA INDUKCYJNEGO W STANACH NIEUSTALONYCH NA PODSTAWIE OBLICZEŃ POLOWO-OBWODOWYCH

DETERMINATION OF ELECTROMAGNETIC TORQUE OF INDUCTION MOTOR IN TRANSIENT REGIMES BASING ON FIELD CIRCUIT CALCULATIONS

Abstract: The paper presents the field-circuit computation results of the deep bar induction motor. The computations of the electromagnetic torque have been carried out for the following transient regimes: the starting with the locked rotor, the 3-pole terminal short circuit and the reconnection at 100% residual field. Calculations have been made for the 460 kW motor, using the programs Maxwell 2D and RMxpert by Ansoft Corp. The computation results of the field-circuit model have been compared with those for the circuit model.

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BADANIA SYMULACYJNE SPRAWNOŚCI OBCOWZBUDNEGO SILNIKA PRĄDU STAŁEGO W WARUNKACH ZMIENNEGO OBCIĄŻENIA

EFFICIENCY SIMULATION RESEARCH OF D.C. SEPARATELY EXCITED MOTOR AT PART LOAD

Abstract: In the article the results of efficiency simulation research of separately excited motor are presented. Motor drive losses can be reduced by controlling the field current and armature voltage for any torque and speed operating point. All these parameters are shown as a function of the load torque at work with minimum total losses. The field current is practical independent of speed and based on it can be realized a simple method for loss minimization in d.c. drive. The simulation research are presented at speed: 500,750,1000,1250,1500 rev/min.