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**SILNIKI INDUKCYJNE Z MIEDZIANĄ ODLEWANĄ KLATKĄ WIRNIKA**

**INDUCTION MOTORS WITH DIE–CASTING COOPER ROTORS**

**Abstract:** Die-cast copper rotor motors as the new kind of the squirrel cage induction motors. Main performance of the motors where copper has been substituted for aluminum in the rotor squirrel cage. Today’s worldwide situation in the field of the production of the die-cast copper rotor induction motors. Perspectives of the industrial expansion of this kind of motors as the profitable alternative to ordinary motors with aluminum squirrel cage.

Maciej Bernatt  
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**SILNIKI PRZEWIETRZANE O WZNIOSACH H=200-355 mm (37-400 kW) TAŃSZE, ALE NIE GORSZE OD SILNIKÓW ZAMKNIĘTYCH**

**VENTILATED ODP MOTORS SHAFT HEIGHTS 200 THROUGH 355 mm, AN ECONOMICAL ALTERNATIVE TO TOTALLY ENCLOSED ONES**

**Abstract:** Design and operating properties of ventilated (open drip proof) induction squirrel cage integral HP motors compared to totally enclosed fan cooled (TEFC) ones. In Europe TEFC motors are regarded as more reliable and better withstanding any environmental hazards. In US the approach to ODP motors is different, ODP motors are regarded as standard. In Poland manufacturing of ODP integral HP motors was abandoned in the 60-70 of the last century. Actually a new series of ventilated ODP motors of shaft heights 200-355 mm have been designed by KOMEL Centre. The motors, IEC degree of protection IP23, will be manufactured by two polish companies. Main features of the new motors incl. test results of 315 kW motor are presented.

Zbigniew Damm  
F.S.E. BESEL S.A., Brzeg

**SILNIKI KLATKOWE PRZECIWWYBUCHOWE BUDOWY WZMOCNIONEJ ZGODNE Z WYMAGANI DYREKTYWY ATEX**

**SQUIRREL – CAGE, EXPLOSION-PROOF, INCREASED SAFETY ELECTRIC MOTORS ACCORDING TO THE REQUIREMENTS OF THE ATEX DIRECTIVE**

**Abstract:** Along with the accession of Poland to the European Union, regulations concerning apparatus for use in potentially explosive atmospheres have been changed. Basic requirements for that apparatus are regulated by the directive 94/9/EC known as the ATEX directive. The paper presents basic requirements of the ATEX directive. Moreover, experiences of F.S.E. BESEL S.A. in production of increased safety, explosion proof electric motors and a method of a protection selection are presented.
SILNIK INDUKCYJNY ZINTEGROWANY Z PRZEMIENNIKIEM CZĘSTOTLIWOŚCI W WYKONANIU PRZECIWWYBUCHOWYM NA NAPIĘCIE 1000 V (1140V)

INDUCTION MOTOR INTEGRATED WITH CONVERTER IN FLAME – PROOF EXECUTION ON 1000 V (1140 V)

[1] Abstract: In mining drives the induction motors, due to their relatively simple design and low price as well as, big reliability are in majority.

[2] The essential failures of this motors is lack of possibility of rotational speed control, that is why the motors require a use of converter installed behind a machine or on machine. The paper presents prototype of the motor connected with converter in one flame-proof casing. In one of the motor’s chambers of set transistor converter of voltage type cooled by water was installed. Control of advance anticipates individual operation of motor, cooperation of two motors where one take over master function and second-slave and cooperation of one or more motors with central controller of master machine where one controller of motor takes a slave function. The solution allows to get economical and operational profits especially in mining machines.

SILNIKI INDUKCYJNE JEDNOFAZOWE O PODWYŻSZONEJ SPRAWNOŚCI I MOCY ZNAMIONOWEJ 7,5 ORAZ 10 HP

ONE-PHASE INDUCTION MOTORS WITH RAISED EFFICIENCY RATED POWER 7.5 AND 10 HP

Abstract: In the paper is described four prototype one-phase motors rated power 7.5 and 10 HP designed and manufactured in Electrotechnical Institute. Motors are designed according to NEMA standards for rated frequency 60 Hz. On account of rated power increase in this motors the special windings with non-uniform distribution of turns are applied. The windings are optimized on account of criterion of possible uniform slot filling by not exceed 3 % content of magnetomotive force third harmonic. For this motors was designed an especial auxiliary start capacitor switch. As actuator is utilized the pair of push-pull connected thyristors. As analyzed parameter for the electronic system is utilized the voltage on the run capacitor. The switch include an unique precision comparator with floating reference voltage. Such solution enabled accurate determination of switching moment by network voltage fluctuation and voltage drops by motor start. Prototype motors was tested and test results indicates, that all motors have better efficiency according to standard motors manufactured by leading American manufacturer and only about 1 % lower as Super-E series motors manufactured by this manufacturer. The paper presents the main motors parameters obtained from tests and also a comparison between tests and calculation results.

MONITOROWANIE PRĄDÓW RÓŻNICOWYCH W SIECIACH PRZEMYSŁOWYCH

RESIDUAL CURRENT MONITORING IN INDUSTRIAL NETWORKS

Abstract: This article describes methods of monitoring residual currents in earthed industrial networks. Shows residual currents relays and residual current monitoring system, which can be used to inform service department about dangerous situations. Describes basic parameters of such devices, which has to be considered before installation.
JAKIE KABLE LUBIĄ FAŁOWNIKI

WHAT KIND OF CABLES ARE INVERTERS FAVORITS

Abstract: In system included frequency converter motor cables, are main source of electromagnetic interference for whole automatic system. Secure of proper operation of the automatic system is conditional on use suitable motor cable. Used cable has to be characterised by electromagnetic compatibility and noise immunity, specified in catalogue. The cable construction is not enough to receive satisfactory level of electromagnetic interference emission. A lot important is proper method of fitting the cable, especially the cable screen to the ground connection. Except the electromagnetic interference we can find other disadvantageous effects during power supply of motors using electric power converters.

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ZASTOSOWANIE WYSOKOTEMPERATUROWYCH MATERIAŁÓW NADPRZEWODNIKOWYCH W MASZYNACH ELEKTRYCZNYCH I TRANSFORMATORACH

APPLICATION OF HIGH TEMPERATURE SUPERCONDUCTING MATERIALS TO ELECTRIC MACHINES AND TRANSFORMERS

Abstract: The paper presents properties of modern high temperature superconducting materials and basic parameters such as critical temperature, critical current density, critical magnetic field which influence them. The influence of the external magnetic field on the HTS material properties is also shown. Possibilities of application of HTS to electrical machines (especially synchronous ones) and transformers are presented. Designs and research conducted by international consortia dealing with these machines are given. General features and basing parameters of synchronous machines with HTS excitation winding are described. The actual development trends in construction and use of HTS generators and synchronous motors are shown. Possibilities of application of HTS to power transformers and induction current limiters are described. Necessary additional equipment for devices using HTS such as cryorefrigerators and current leads is generally characterized.

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SILNIK ASYNCHRONICZNY Z WIRNIKIEM Z PŁYNNEJ STALI

ASYNCHRONOUS MOTOR WITH ROTOR OF LIQUID STEEL

Abstract: To achieve high quality and homogeneity of steel, in technology – continuous casting technology stirring and mixing of melt should be done. The paper describes equipment for stirring provided by rotating magnetic field. The magnetic field is generated by two-pole copper coils placed on the core made of electrotechnical laminations. The winding is supplied from low-frequency converter. In Research and Development Centre of Electrical Machines KOMEL two types of stirrer were designed and manufactured for “Huta Zawiercie” steelworks. First stirrers work over 6 years without damage, the second part of larger stirrers were implemented in 2004.
STAN NAPRĘŻEŃ I ODKSZTAŁCEŃ W ŁOPATKACH WENTYLATORÓW SILNIKÓW ELEKTRYCZNYCH

STRESSES AND DEFORMATIONS IN FAN VANES OF ELECTRIC MOTORS

Abstract: The paper refers to issues connected with damages of fans used in large power inductive motors. Examples of damages of fans are presented (Fig. 1 and 2) as well as their influence on damages of stator windings of a motor (Fig. 3). Analysis of loads acting on fan vanes under transient and steady states is performed. A model has been carried out (Fig. 5) to calculate deformations and stresses in vanes (Fig. 4) of a fan is presented on Fig. 1b using software based on MES. Results of stresses distribution of vanes caused by: centrifugal forces, air resistance as well as angular acceleration (Fig. 6 to 9) are presented. Calculations of free vibration frequency of fan vanes (Fig. 10) were made. The paper ending includes conclusions of analysis of stress state in fan vanes obtained from computer calculations and analysis of damages of fans.

Zbigniew Rasz, KWK „Kazimierz – Juliusz” Sp. z o. o. Sosnowiec
Artur Polak, BOBRME Komel, Katowice

DOŚWIADCZENIA EKSPLOATACYJNE Z SILNIKIEM SYNCHRONICZNYM

EXPERIENCE IN EXPLOITATION OF SYNCHRONOUS MOTOR

Abstract: The article presents authors’ experience with exploitation of synchronous motor. The motor is a part of Ward-Leonard system. Since mounting in 1970, the motor has been still in use. It was a main construction of electrical machines for industrial use that time.

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WYBÓR CHWILI ZAŁĄCZENIA NAPIĘCIA WZBUDZENIA PODCZAS SYNCHRONIZACJI SILNIKÓW SYNCHRONICZNYCH

SELECTION OF EXCITATION START-UP MOMENT DURING 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 motor characteristics make it suitable for drives of fan – type machines. The work presents description of computable model and general parameters of analyze two–speed motor. The analytical relations that describe the asynchronous motor state in the moment of the beginning synchronization process and the torque-angle characteristic as result numerical analysis were present. The influence of the synchronization moment, during synchronization process with nominal excitation voltage and greater then nominal value, on stator currents, electromagnetic torque and shaft velocity were examined. Dynamic diagram of stator currents, excitation current, excitation voltage, electromagnetic torques and shaft velocity during synchronization process as results of computer simulation are presented.
Abstract: The paper deals with comparative analysis of parameters describing the electric power drawn from a medium voltage industrial network by 2MW of nominal power electric drives of copper bars rolling mill. The comparison was possible in consequence of modernization of the rolling mill’s main drive, which included replacement of the thyristor DC drive by an asynchronous drive fed from a DTC converter. The computational analysis of active, reactive, apparent and deformation power was conducted on the basis of recorded voltages and currents for both versions of the drives. Characteristic indices of the power quality were determined as spectra of the voltage and current harmonics as well as total harmonic distortion (THD) coefficients of the voltage and current. MATLAB and DASYLab software was used for measurements and computations. The results obtained from the analysis show that the controlled AC drive has smaller negative impact on the supply network in comparison with the equivalent thyristor DC drive. Consumption of the reactive power and deformation power was reduced respectively by order of magnitude and about 50%. It is a consequence of increased power factor and significant reduction of rms values of the first and higher harmonics of the current drawn from the network by the drive with a frequency converter comparing to the drive with a thyristor rectifier.

Diagnostic of Electrical Machines in Power Plants – Practical Examples

Abstract: This paper presents the diagnostic methods used in power stations to evaluate the technical conditions of electric machines which have been used for years in the Opole Power Station. The thermovision technics used to diagnose rotor cages in induction motors are described in detail. A method to evaluate insulation windings conditions through the introduction of diagnostic factor for them is presented. Examples of such an evaluation and its practical application are included.

Diagnostics of Insulation High Voltage Induction Motor Off-Line in Industry

Abstract: The article presents an application of diagnostic insulation high voltage induction motor off-line in industry. The paper contains an analysis of different diagnostics methods. It the usefulness of method was has talked over was in peculiarity using measurements PI, C, DD i SV - Polarization Index Testing, Capacitance, Dielectric Discharge Testing, Step Voltage Testing. The examples of results of measurements state isolation interesting industrial cases were passed.
INTERACTION ASPECTS OF PULSE STRESS AND INSULATION SYSTEMS

WPŁYW ZASILANIA IMPULSOWEGO NA UKŁADY IZOLACYJNE MASZYN ELEKTRYCZNYCH

Abstract: In the past twenty years, industrial controls have experienced dramatic changes with advances in adjustable speed drive technology. It has been observed that voltage waveforms generated by power frequency converters may affect significantly the reliability of electric motor insulation system. Over voltage problems in long cable drives due to step voltage pulse rise time became an important research area during the last decade. The over voltage phenomenon is usually described using the traveling wave and reflection phenomena. For better understanding of the processes in long cable drives distributed-parameter representation in simulations is used. The problem with bearing currents is well known. Besides magnetic dissymmetries, other causes exist for bearing currents, such as voltage potential accidentally applied to the shaft, electrostatic charge accumulation, and common-mode voltages generated by unbalanced excitation of the motor windings. Any of the above could cause bearing currents and bearing failures. Recently, common-mode voltages with high frequency and high dv/dt have been a major cause of bearing currents and premature bearing failures in high-frequency inverter-fed, induction motors. This paper deals with this topic, showing experimental evidences between electrical insulation materials life time under two different voltage conditions.

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Partner Serwis, Kwidzyn

WYKRYWANIE STOPNIA DEGRADACJI IZOLACJI ZWOJOWEJ METODĄ UDARÓW NAPIĘCIOWYCH

DETECTION FAULTS BETWEEN TURN TO TURN INSULATION USING THE SURGE TEST METHOD

Abstract: In the article has been described the surge test theory. The paper presents diagnoses and results from the surge tests. Tests include some amplitude-frequency characteristic curves. Some examples of good windings and windings with different degree of the damaging insulation. Author took advantage of experimental results stored in the year 2004 when made tests on insulation winding DC and AC motors. He wanted to explain that this method called comparative test can be used to test insulation in non symmetrical windings. The article wants using this method with connection DC voltage insulation system test.

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O MOŻLIWOŚCI WCZESNEGO WYKRYWANIA PĘKNIEĆ PRĘTÓW KLATKI WIRNIKA PODCZAS PRACY MASZyny ASYNCHRONICZNEJ

ABOUT CAGE BARS CRACK EARLY DISCOVERING POSSIBILITY DURING INDUCTION MOTOR WORK

Abstract: Some utilizing possibilities of induction motor stator phase current vector function hodographs as diagnostic signals to rotor cage bars (rings) ruptures early discovering during machine work have been described in the paper. As a result of rotor asymmetry, caused by cage bars ruptures, some (1±2k)f frequency band currents are induced in the stator, which are overlapping current base frequency (f=50Hz) component. In cases of rotor damages, hodograph course is deformed, comparing to not damaged motor hodograph course. Hodograph deformations, characteristic for rotor bars ruptures have been illustrated by a lot of oscillograph records received during laboratory investigations. These investigations have been carried out for damaged motor feeding cases by voltages from power network and from voltage frequency changers. Hodograph deformations characteristic features for rotor bars...
damage cases are also seen during simultaneous appearance of other disturbances as, for example, impedance asymmetry in one of phases or feeding voltages. It’s properly to remark that with the number of ruptured bars the diagnostic signal value and its pulsation can diminished and even lesser values can be received then for little number of ruptured bars. For this reason it’s useful to carry out the best continuous or from time to time cage bars control (monitoring), because it permits to discover damages already in initial stadium and by this to exclusion next bar damages and serious machine damages appearance. Diagnostic method proposed should be numbered to non invaded methods.

In the solution, which is based on observation and evaluation of motor stator phase current hodographs, could be approved generally machine current measuring system which exist in industrial systems.

ZASTOSOWANIE ANALIZY CZĘSTOTLIWOŚCIOWEJ PRĄDU DO WYKRYWANIA USZKODZEŃ WIRNIKÓW SIŁNIKÓW INDUKCYJNYCH ZASILANYCH Z PRZEMIENNIKA CZĘSTOTLIWOŚCI

APPLICATION OF CURRENT FREQUENCY ANALYSIS TO ROTOR FAULTS DETECTION OF CONVERTER-FED INDUCTION MOTOR

Abstract: The paper deals with the application of frequency analysis of stator current to rotor fault detection of the induction motor. Special attention was focused on spectral analysis of magnitude of stator current space vector, which enables easier monitoring of current harmonics magnitudes with frequency specific to the different faults. Presented results show that combining of the current spectral analysis and neural networks enables the development of hardware fault detector of the converter-fed induction motor. The design methodology of the neural fault detector was presented and results of the detector on-line operation were demonstrated in the real laboratory system.

SILNIKI ELEKTRYCZNE Z MAGNESAMI TRWAŁYMI UMIESZCZONYMI NA WIRNIKU

ELECTRIC MOTORS WITH PERMANENT MAGNETS PLACED IN THE ROTOR

Abstract: Electric motors with permanent magnets placed along rotor’s circumference may operate as:
- synchronous motors with permanent magnets (PM SM)
- sinusoidally controlled brushless dc motors with permanent magnets (PMDC BMSC)
- trapezoidally controlled brushless dc motors with permanent magnets (PMDC BMTC).

In each case the electromechanical properties of the drive are different, this is influenced by the control method and electromagnetic field distribution in the armature slot. The induction distribution should induce sinusoidal rotation voltage in the armature winding of PMSM and PMDCBMSC and trapezoidal rotation voltage in PMDCBMTC, respectively.

Synchronous motors are supplied with voltage of set (forced) frequency. The rotational speed is controlled by changing the supply voltage frequency. The mathematical model of synchronous motors in steady and quasi-steady states is given in Equations (2-10).

The electronic commutator in brushless pm motor is built into the motor, same as mechanical commutator in dc motors. The electronic commutator is supplied with dc voltage. The windings’ current is of variable character, but its frequency depends on the rotational speed of the motor. This speed is controlled and set by changing the electronic commutator supply voltage. If the current waveforms generated by electronic commutator in A, B, C phases windings are trapezoidal, then the motor is denoted as trapezoidally controlled. The mathematical model of this motor is given in Equations (11-14). If the current waveforms generated by electronic commutator in A, B, C phases windings are sinusoidal, then the motor is denoted as sinusoidally controlled. The mathematical model of the motor is given in Equations (15-20).
BADANIA UKŁADU NAPĘDOWEGO Z SILNIKIEM BEZSZCZOTKOWYM (PMSM) O MOCY 20 kW

20 kW BRUSHLESS AC MOTOR (PMSM) DRIVE SYSTEM RESEARCH

Abstract: In the article the results of research into 20kW PMSM drive system are presented. Tested system has consisted of brushless AC motor prototype driven by frequency converter. Control system has been built with the help of specialized DS1104 card being part of PC. The simulation research has been done using drive model, which had been worked out using Matlab-Simulink. The results of computer simulation research as well as of experimental tests are presented in the article. Obtained waveforms turn out to be satisfactory and will be starting point for research into drive system designed for traction vehicle in the future.

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WPŁYW PARAMETRÓW WYJŚCIOWYCH FALOWNIKÓW PWM I KABELA ZASILAJĄCEGO NA ZJAWISKA PASOŻYTNICZE W SILNIKACH INDUKCYJNYCH

INFLUENCE OF THE PWM INVERTERS OUTPUT PARAMETERS AND POWER CABLE ON THE ADDITIONAL PHENOMENA OCCURING IN INDUCTION MOTORS

Abstract: In the paper additional phenomena occuring in induction motors supplied from PWM inverters are presented. The voltage pulse generated by frequency converter is shown in Fig. 1 and Fig. 2. In Fig. 3 the common-mode voltage for two first inverter voltage output harmonics is shown. In Section 3 voltage generation on the frame of the induction motor supplied from PWM inverter are discussed. Measurement results are presented in Section 6 in Fig. 6 to Fig. 12.

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GENERATORY SYNCHRONICZNE DLA AUTONOMICZNYCH BEZPRZEKŁADNIOWYCH ELEKTROWNI Wiatrowych

SYNCHRONOUS GENERATORS FOR INDEPENDENT DIRECT-DRIVE WIND POWER PLANTS

Abstract: For the correct definition of capital expenses and working costs, for the development of an autonomous wind power plant, it is necessary to take into account the features of the consumers of electric energy, modes of their work, time power diagrams of winds for the given district, and also, a whole series of other factors. The construction circuit of such electric station is considered. It is recommended to use the gearless stations that are equipped with low-speed synchronous generators with excitation from permanent magnets for the purpose of maximal use of energy small winds. The front design of the synchronous generator is well coordinated with various kinds of wind wheel. The offered block-modular design of the electric machine provides an opportunity of manufacturing of generators with the capacity from 1 up to 10-15 kW from the unified elements and standard blocks. The description of a design of the generator and its elements is given in this article. Generators have good technical and economic parameters, high reliability, and practically do not demand service. Wind power plants with offered generators can be used for various types of equipment such as drives of water pumps, air conditionings, heating of water, heating, and other economic needs. Generators can find applications in small hydro-power engineering.
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Andrzej Beżański, Jachtowy Kapitan Żeglugi Wielkiej

MAŁE ELEKTROWNIE WIATROWE – PRZYKŁADY PRAKTYCZNEGO ZASTOSOWANIA

SMALL WIND POWER PLANTS – EXAMPLES OF PRACTICAL USE

Abstract: The paper describes small yacht’s wind power-stations (also called wind-mills) designed and made by Komel Centre (Katowice, Poland). After marine tests of the first windmill (diameter 1 m) the second, smaller one (diameter 0.75 m) was designed and manufactured. The windmill having nominal output 120 W at wind 12 m/s is intended to be installed on yachts of size up to 15 m. The paper shows results of exploitation tests of the wind power-station, also during very strong wind (up to 22 m/s). In both wind mills permanent magnet alternator designed and manufactured by Komel were used. The alternators having very high efficiency do not have any brushless and can be used in hard working conditions in marine duty.

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NAPĘDY ELEKTRYCZNE WIELOBIEGOWE

MULTI-SPEED ELECTRIC DRIVES

Abstract: Multi-speed electric drives are usually used in these cases, where work cycle of a given drive requires two or more different rotational speeds. Examples of such drives are pumps, fans, centrifuges, lifts etc. Another reason for using multi-speed drives is decreasing the energy consumption. Low energy consumption is ecological and economical criterion of the drive. If energy is not spent unnecessarily, then it need not be generated. About 98 of electrical energy in Poland is produced by burning coal and therefore, if less coal is burnt, the emission of carbon dioxide, sulphur dioxide and nitrogen oxides goes down. Lower speed of the drive causes diminished wear of driven mechanical devices and decreases generated noise; a good instance of such drive is belt conveyor. Energy-saving drive is the type of drive drawing minimum energy from the network necessary from the viewpoint of the engineering process – Fig.1. Energy required for engineering process during time \( t \) (e.g. day, month, year) is equal to. The driven mechanical system imposes load torque \( T_{lb} \) and angular speed \( \omega_m \) on the motor. Equation (1) shows that the minimum energy consumption is achieved, when the drive operates at minimum allowable angular speed (\( \omega_{m\,\text{min}} \)). Usually the load torque is also minimum under such conditions. This type of working cycle algorithm in modern electric drives can be obtained by using cage induction motor supplied from power electronics converter (inverter). If we assume that, for a chosen drive, e.g. belt conveyor, the energy consumption per time unit (e.g. \( t = 24 \) h):
- is equal to 100 per cent, when angular speed is kept constant (\( \omega_m = \text{const} \))
- drops down to 50 per cent in accordance with \( \omega_{m\,\text{min}} \) criterion (for a belt conveyor this speed corresponds to 100 per cent loading of the belt),
then when two-speed drive is used, the energy consumption will go down to c. 70 percent, and with three-speed drive to c. 60 per cent. Two- or three-speed drive is cheaper and as easy to design as one-speed drive. Multi-speed drives can utilize the following motors:
- multi-speed cage induction motors,
- system of two induction slip-ring motors, supplied either individually or as a cascade system,
- synchronous motors of special design, stator winding with switchable number of poles,
- induction or synchronous motors supplied either from the network or from power-generator set (lower frequency, also lower voltage).

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DWUBIEGOWY SILNIK INDUKCYJNY O STOSUNKU PRĘDKOŚCI OBROTOWYCH 1:3

POLE CHANGING INDUCTION MOTOR WITH 1:3 SPEED RATIO
Abstract: This paper describes a new concept of using conventional induction motor as a two-speed induction motor. By switching supply from three-phase to single-phase with all windings connected in series, it is possible to triple the magnetic pole number. There are shown basic properties of such a solution. Results of FEM calculation including flux pattern and normal component of flux density along an airgap are presented. Torque-speed and current-speed characteristic of studied motor are also presented. Some transients including torque, speed, and current versus time during start-up and switching to single-phase supply are shown.

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ROZRUCH SILNIKA INDUKCYJNEGO ZASILANEGO Z FAŁOWNIKA ŚREDNIEGO NAPITCIA Z UWZGLĘDNENIEM SYNCHRONICZNEGO PRZEŁĄCZENIA NA SIĘĆ

START OF THE CAGE INDUCTION MOTOR SUPPLIED FROM INVERTER AND TRANSIENT CONDITIONS RELATED TO TRANSFER TO SUPPLY GRID

Abstract: The paper presents a method of starting a large cage induction motor. The starting process consists of two main states. In the first state, a power electronic converter is used to control the speed and current of the accelerating motor. Therefore, the grid current is fully controlled and adjusted to the reference. In the second state, the power electronic converter is off, and the motor is connected directly to the grid. A method of synchronization of the induced emf. of the motor to the grid voltage reduces transient current and starting time. However, relatively long time of the mechanical transfer switch operation results in displacement of the emf. and then adequate increase of the stator current.

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WYBRANE ZAGADNIENIA STEROWANIA UKŁADU NAPĘDOWEGO Z POŁĄCZENIEM SPRĘŻYSTYM

CONTROL OF THE DRIVE SYSTEM WITH ELASTIC JOINT—SELECTED PROBLEMS

Abstract: In the paper, the analytical design procedure for classical and modified speed control systems with PI controller is presented. The analytical equations which ensure the setting of control structure parameters are given. The nonlinearities existing in the drive system are discussed. The problem of control signals limitation was focused on. The dynamic behavior of the considered control structures with different speed controllers has been examined using experimental set-up.