ABSTRACTS OF THE SCIENTIFIC PUBLICATIONS

SUBMITTED FOR PARTICIPATION IN A COMPETITION FOR ACADEMIC POSITION "ASSOCIATE PROFESSOR"

PROFESSIONAL AREA 5.2. "ELECTRICAL ENGINEERING, ELECTRONICS AND AUTOMATIC"

SCIENTIFIC SPECIALTY "ELECTRICAL APPARATUS"

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Chief Assist. Prof. PhD Tatyana Marinova Dimova

Dep. Electrical engineering and electrotechnology,

Technical University of Varna

The summaries of the publications from group B.4. – scientific publications in publications that are referenced and indexed in world-renowned databases with scientific information, which are equivalent to a monographic work in one thematic area.

B.4.1. Dimova T., Marinova M., Aprahamian B., Investigation of the Magnetic Field of a Separator with Specific Configuration of the Magnetic Filter, Proceedings of 19-th International Symposium of Electrical Apparatus and Technologies SIELA, 2016, pp. 72-75

The magnetic separation is a process of great practical relevance. The specifics of the separated material determine the type of the used separator. The aim is to achieve the maximum degree of purification of the processed product. The article examines a construction of real magnetic separator type MCR 5 with a specific problem defined by the practice. The analysis was conducted using a specially developed mathematical models based on the finite elements method. Models of the separator's structure with ferrite material concentrators and gaps of non-magnetic material were examined as well as those with different orientation of the magnetic induction vector of the individual permanent magnets. The stationary magnetic field of the system is analyzed as a flat parallel system, taking into account the nonlinear properties of the materials, which are separated by the separating apparatus. Also are examined the influence of the thickness and the material of the outer body (housing) of the separator. The distribution of the field is modeled numerically using the finite elements method and the software package FEMM 4.2. The results allow to optimize the structure of the magnetic separator and to achieve the highest level of purification.

Permanent magnet separators are widely used in various fields of industry, such as: mining, food processing, pharmaceutics glass manufacturing, and many others. The principle of operation of these devices is based on the fact that materials of different magnetic properties interact with the magnetic field in a different way. The object of study in the present work is a permanent magnet separator designed for separation of ferromagnetic particles from sunflower seeds at the stage of pre-packaging. The purpose is to develop a specific design of a separator, where the size and the configuration of the permanent magnets is such that it could make it possible to increase the magnetic force acting on the ferromagnetic particles and in this way to achieve a more effective separation. The idea is to solve a problem of a private company for processing seeds and industrial crops.

B.4.2. Dimova T., Marinova M., Aprahamian B., Assessment of the Influence of the Magnetic Filter Type on the Magnetic Field of a Separator Type MCR-5, Proceedings of 19-th International Symposium of Electrical Apparatus and Technologies SIELA, 2016, pp. 76-79

The magnetic separation is a process of great practical relevance. The specifics of the separated material determine the type of the used separator. The aim is to achieve the maximum degree of purification of the processed product. The article examines a construction of real magnetic separator type MCR 5 with a specific problem defined by the practice. The analysis was conducted using a specially developed mathematical models based on the finite elements

method. Models of the separator's structure with ferrite material concentrators and gaps of non-magnetic material were examined as well as those with different orientation of the magnetic induction vector of the individual permanent magnets. The stationary magnetic field of the system is analyzed as a flat parallel system, taking into account the nonlinear properties of the materials, which are separated by the separating apparatus. Also are examined the influence of the thickness and the material of the outer body (housing) of the separator. The distribution of the field is modeled numerically using the finite elements method and the software package FEMM 4.2. The results allow to optimize the structure of the magnetic separator and to achieve the highest level of purification.

Therefore, the effectiveness of separation depends on the magnetic, mechanical and internal forces, which act on the particles and is a function of the nature of substances, type of separating facility and conditions of conducting the process.

Another purpose of permanent magnet separators is to obtain maximum purification at a minimum number of separations. This can be achieved by proper design of the magnetic filter, i.e. by obtaining a non-uniform field in which maximum effectiveness of the process will be obtained.

To achieve all this, it is best to use computer models, through which to evaluate the effectiveness in relation to the coefficient of non-uniformity.

The purpose of this work is to assess the impact of different types of magnetic filters relating to the arrangement of the permanent magnets and the partioning gaps to achieve maximum degree of purification at fixed design parameters of the separator. The partioning gaps are made of non-magnetic, paramagnetic or ferromagnetic material.

The created 2D models enable a preliminary evaluation of the magnetic field. With the introduction of gaps of magnetic and non-magnetic material between the magnets, a higher residual induction is achieved and better coercive force, which guarantees higher effectiveness of the separating device.

- By providing gaps of non-magnetic and magnetic material, the following is achieved:
- Decreased number of permanent magnets, which will result in a decreased price of the device;
- Decreased weight of the separating device;
- Higher degree of purification.

The developed versions with ferromagnetic concentrators between each of the permanent magnets show that this is a good option for implementation of the magnetic filter, because the accumulated magnetic energy in the concentrators results in a greater force of attraction of the ferromagnetic particles in the product.

B.4.3. Dimova T., Marinova M., Aprahamyan B., Marinov T. M., Investigation of the exploitation modes on a special type separator, Proceedings of 15-th International Conference on Electrical Machines, Drives and Power Systems ELMA2017, pp 444 - 447

The persent work is dedicated to the study of a separator with permanent magnets designed for processing of non-fat sunflower meal before it enters a ball mill.

In recent years, technological equipment has to be replaced in many industrial productions where separators with permanent magnets are used in some of the key technological processes. Depending on the operating modes separators undergo preventive inspection and their effectiveness is determined in a series of investigations and tests. Regardless of what the raw material is, it is subjected to processing in order to obtain a pure product with certain quantitative and qualitative indicators meeting the standards. Not least, it is important to preserve the technological equipment and achieve more efficient use of raw materials.

The persent work is dedicated to the study of a separator with permanent magnets designed for processing of non-fat sunflower meal before it enters a ball mill. The objective of the paper is to ascertain that the content of iron impurities in the material under treatment is close to zero so as to obtain pure product and to prevent damage to the mill. This is achieved through regular and timely cleaning of the separator, precise specification of the modes of its operation and of the reliability of its magnetic filter. The treated material is examined at the end of the technological cycle for the quantity of separated ferromagnetic impurities. Experiments have been conducted on the working order of the magnetic filter of the separator with permanent magnets. It has been proved possible to obtain such unevenness of the magnetic field, though which to obtain increased intensity of the field or, similarly, to do so by replacing permanent magnets with alternative ones. Recommendations have been given for proper reconstruction and repair. Through mathematical modeling, the magnetic field of separator type E15 has been analyzed.

A suitable option for replacing a sector of its magnetic filter has been found, which increases the degree of purification and prevents damage to the assembly line.

In the development phase are now industrial prototypes of a separator, on the basis of which tests are being conducted on the technology of purification of various raw materials in industrial conditions.

B.4.4. Dimova T., Streblau M., Aprahamyan B., 3D Modeling of the Magnetostatic Field in Separation Apparatus, Proceedings of the First International Conference on High Technology for Sustainable Development HiTech 2018, 2018, pp. 223 – 225

This paper is devoted to three-dimensional mathematical modeling of the magnetostatic field in separation apparatus. The created models are based on a specific practical task, given by the manufacturer of the technological equipment. Conclusions are made about the used permanent magnets in the investigated magnetic separators. Using the COMSOL Multiphysics software are developed different versions of the configuration of the magnetic system in order to achieve a maximum degree of purification expressed in maximum extraction of ferromagnetic particles.

Electromagnetic separators are expensive, cumbersome and unreliable devices. These and other objective reasons make permanent magnet separation apparatus increasingly sought after and turn them into a subject to continuous improvement by a number of companies on the international market. Mathematical computer modeling helps manufacturing companies to be accurate, attractive, and competitive in the field of machine building. That is why the paper is dedicated to the 3D modeling of cascade permanent magnet separators.

The paper has four pillars: research - evaluation - analysis - impact. The aim is to make an objective assessment of the actual condition of different types of separators based on theoretical

and experimental research and analysis of the obtained results. The designation is to investigate and justify the possibilities for analysis of separating apparatus and on this basis to develop specific technical solutions for increasing the efficiency of operation and the methods for control, diagnostics and improvement of the quality and operation parameters of different types of permanent magnet separators.

In the course of the theoretical investigation a mathematical apparatus, which is described in detail of anoder authors, was used in addition to the performed analyzes performed and the drawn conclusions. The coordinates of motion of the separated particles are added.

The obtained theoretical results are experimentally verified under particular concomitant conditions. A computer model for analysis of the magnetic field distribution and analysis of emergency regimes such as impassability and clogging of the separator has been developed. The aim is to improve operating regimes in order to obtain the maximum level of extraction of ferromagnetic impurities from food and other bulk products. The described separators are implemented in practice.

The conducted study allows making a number of conclusions concerning the used permanent magnets in the separating apparatus. The choice of the type of material for the permanent magnet is determined by the technical requirements, the operating conditions, the economic indicators and the technological restrictions of the particular separation apparatus. Materials which have high field intensity Hc are used for permanent magnets despite the fact that their magnetic energy is small. Nonetheless, the permanent magnet should be of minimal size and at minimal cost. These requirements are mutually contradictory, but in constructive designs a compromise solution is possible to be reached.

B.4.5. Dimova T., Aprahamian B,, Marinova M., Research of the Magnetic Field Inside a Drum Separator With Permanent Magnets, Proceedings of 16-th International Conference on Electrical Machines, Drives and Power Systems ELMA, 2019, pp. 621–624

The paper presents a study of the pattern of the magnetic field inside a drum separator with permanent magnets. The construction of the separator and the position of the permanent magnets are described, and data are obtained experimentally along the longitudinal and cross axis of the drum separator. Attention is paid to the characteristics of the used magnetic material and its properties. By computer modelling, a pattern is obtained of the magnetic field of the separator. A comparison is made between the obtained results and the conducted experiment. Analysis is made of the possibilities to improve the operating regime of the separator by using novel magnetic materials for permanent magnets.

The availability of organic and inorganic impurities in the raw materials causes changes in their physical and chemical properties which entails various flaws of the end final product: from changes in the outside appearance (merchantability) to structural changes of various kinds. Depending on the requirements which are laid on to the raw materials, various techniques are applied for separating harmful impurities, the notion of separation summarizing all of them.

In order to satisfy the growing demands and to cope with the pressure of high prices, as well as to protect their competitive advantages, production businesses have to provide the shortest production cycle and the fastest update for their products. They work in two main directions:

continuous cost reduction and innovative product improvement. In order to satisfy the growing demands and to cope with the pressure of high prices, as well as to protect their competitive advantages, production businesses have to provide the shortest production cycle and the fastest update for their products. They work in two main directions: continuous cost reduction and innovative product improvement. Right here (this is the place where) the construction designs of the separators are successfully introduced and improved.

The aim of this paper is to model the picture pattern of the magnetic field in a concrete particular modular system (double drum separator with permanent magnets) and to prove the adequacy of the model through comparison with the experimentally obtained characteristics.By modeling the separator it is possible to improve its operation and to set up the structure for different separated materials.

From the realized experimental research the following conclusions have been made:

* The theoretical approach presented here allows a visual, fast and easy definition of the distribution of the magnetic field in the operating zone of the separator with a variable configuration withset characteristics of the permanent magnets.

* A comparison of the theoretical and experimentally registered data shows a deviation of about 10%. This permits to use the developed program model for future partial optimization of the constructive solutions for achieving a qualitative and efficient separation.

* The appropriate choice of the material for the magnets is of considerable significance for the improvement of the characteristics of the separator with permanent magnets. This would allow the separation both of ferromagnetic and paramagnetic materials.

B.4.6. Dimova T., Theoretical and experimental study of drum electromagnetic separator for waste material, Proceedings of 21-th International Symposium on Electrical Apparatus and Technologies SIELA 2020, pp. 85 - 88

Owing to its numerous advantages, magnet drum separator finds wide application in industry nowadays. This raises some questions related to the theoretical and practical applications of these methods of magnet field treatment. In order that the quality and effectiveness of their application be enhanced, the existing methods of research and improvement of the constructive solutions need to be made preciser. The solution of the above questions requires application of new mathematical models and computer methods of research. In this paper research the device of electromagnetic drum separator for waste material. The described mathematical model has been realized by the method of finite elements. In support to the theoretical research, an experiment has also been conducted in order to assess the adequacy of the model.

In the last years, the environmental issues have gradually changed their pollution standards towards lower tolerable concentrations on ferromagnetic particles than those of the past with respect to the industrial waste materials. One of the methods for separation of loose materials is by using electromagnetic excitation. The advantage is that a stronger field can be obtained and its value can be regulated. The basic constructive point of the separator being studied consists of electromagnets with alternating polarity, and between them are positioned concentrators. The separator is designed to separate ferromagnetic particles from non-magnetic ones; the material being handled is subjected to mechanical and magnetic forces so that the particles with different magnetic properties could take different trajectories of movement. This leads to the need to

develop more compact and simplified processes and a separation apparatus. In this paper have been investigating the magnetic separation technique for the ferromagnetic particle from waste materials.

The aim of this study is, based on experiments conducted on an actual magnetic separator with electromagnetic excitation, to build a model separator corresponding to the actual in order to optimize its design.

The model thus realized allows separation of ferromagnetic mixtures from non-magnetic. The experimental study of the magnetic field in the area of separation at various electromagnetic excitation.

The results could be used for optimization of the separation process for ferromagnetic materials with different electromagnetic permeability. A mathematical model has been developed for studying the picture of the magnetic field with various values of excitation. The results thus obtained coincide with the experimental ones, which proves the adequacy of the model. The mathematical model could be used to study larger electromagnetic systems for preliminary assessment of the technological possibilities for separation of loose materials.

For the particular object of separation, it is possible to determine the minimum and maximum values of thickness of the layer of the treated product, at which the process of separation is effective.

B.4.7. Tatyana Dimova, Bohos Aprahamian, Maik Streblau and Marin T. Marinov, Investigation of the Magnetic Forces in Drum Separator with Permanent Magnets, , ICAI 2021 International Conference Automatics and Informatics, 2021, pp. 398 - 401

This paper presents an investigation on the magnetic forces in drum separator with permanent magnets, designed for separation of ferromagnetic impurities from granulated materials in bulk. An approach to determine the magnetic forces acting in the process of purification of some mass of sunflower seeds, taking into consideration the parameters determining this process is presented. The emphasis is on the influence of these parameters on the process of separation.

In magnetic sorting, the action of magnetic forces is used to separate ferromagnetic components from a product. The effectiveness of the magnetic system for separation depends to a large degree on the form of the magnetic poles which determines the pattern of the magnetic force lines. This condition holds true for all kinds of separators with permanent magnets regardless of their constructive particularities or their form or the type of their magnets. Since the separators with permanent magnets are flexible systems which do not need electric power to operate, a great number of industries use their benefits such as high effectiveness, inexpensiveness and mobility. The latter defines the feasibility of their application.

The aim of the present investigation has been to conduct experiments with a drum separator whose design is one of the most commonly used in practice in order to determine by a known from other publications mathematical model the size of the magnetic force for a specific product under treatment depending on various parameters, such as: thickness of the treated layer and form and sizes of the extracted particles. To achieve this goal, the study was performed in the following order: 1. Mathematical description of the process of separation; 2. Modeling the

process using the finite elements method and confirmation of the theoretical results by real experiments.

In separation by separators with permanent magnets, the force of the magnetic field is determined by the materials of which the magnets are made and by the intensity of their initial magnetization. The modern advancement of technologies for their production allows that they are made of alluminium-nickel-cobalt steels and neodymium-iron-boron, whose magnetic force remains intact for indeterminate period of time at temperatures up to 400°C. In addition, the manufacturers of magnets have developed a technology for making magnets from oxide-ceramic materials which can also keep their residual magnetic induction for indeterminate time. These materials are widely used in the production of drum separators.

Based on long-year experience in production of magnet separators and extensive measurements of the magnetic field, many companies have developed a wide range of separators with permanent magnets which allow a very good separation of minerals and metals between the poles of the magnets and separation of ferromagnetic particles of various sizes in the sector of diffusion of the magnetic force lines.

From the completed investigations the following conclusions are drawn:

1. For a known construction of drum separator a mathematical model has been built and an algorithm has been developed which allows computing the magnetic forces necessary for proper separation of specific product (e.g. sunflower seed mass), which is treated depending on its dynamic characteristics – coefficient of diffusion, lateral pressure, friction along the separator's active zone and angle of natural repose.

2. For a given product of separation, the minimal and maximal values of the thickness of the layer of the treated product, at which the process of separation is effective, are determined.

3. The obtained dependences exhibit that the magnetic force in the volume of the particles decreases with increasing the radius of the separator, regardless of the shape of the particles. The weight of the ferromagnetic particles remains also an important factor.

4. The obtained dependences exhibit that when the radius of the drum separator increases, the magnetic force required to separate the ferromagnetic particles also increases, due to the working area increase, and at the same time the scattering and material inputs also increase.

5. The choice of the type of material of the used permanent magnets is determined by the technical requirements, the operating conditions, the inexpensiveness and the technological restrictions of the specific separation apparatus. Materials with high field intensity Hc are commonly used for permanent magnets despite the fact that their magnetic energy is relatively small. Nonetheless, the permanent magnet should be of minimal size and at minimal cost. These requirements are mutually contradictory, but in constructive designs of separators, a compromise solution is possible to be reached.

B.4.8. Tatyana Dimova, Bohos Aprahamian, Maik Streblau and Marin T. Marinov, Determining the Magnetic Forces in a Suspention Type Separator with Permanent Magnets, ICAI 2021 International Conference Automatics and Informatics, 2021, pp. 402 - 405

The paper presents an investigation on a separator with permanent magnets designed for separation of ferromagnetic impurities from bulk materials. An approach to determine the

magnetic forces, taking into consideration the parameters determining these forces is studied. The influence of the latter on the process of separation is investigated.

The advantages of the permanent magnet separators – energy efficiency and mobility define the feasibility of their further sophistication and their effective use. It is of significant importance for their optimal application the proper design and computation of the magnetic system and especially the magnetic forces within the working area and the main parameters which influence the process of separation.

This define the aim of the present study: to specify and summarize the parameters which influence the process of separation and to find a different approach apart the existing method of electromagnetic analogy while determining the magnetic forces in a suspension type separator with permanent magnets.

The separators with permanent magnets may be of various constructive configurations depending on the specific technological requirements of the production processes and the kind of materials being treated.

The widest use in practice have the separators with permanent magnets of drum type which are used in various traditional industries. It is about them that mathematical formulae and experimental coefficients have been deduced with regard mainly to the radius of the drum and the sizes of the eliminated particles. However, other types of separators – suspension type (e.g. suspended above the conveyor belt), lamella type, grid type and so on, whose standardized constructions have a number of advantages over the drum separators.

Making some changes in the configuration of the magnetic system or the pattern of the magnetic field and changing the material of the permanent magnets, additional advantages can be achieved for the magnetic separators In this connection it is interesting to consider the suspension type separator. In separators with permanent magnets the force of magnetic field is determined by the materials from which the permanent magnets are made and by the intensity of initial magnetizing of the magnets which value is defined by the specific requirements of production process.

The analytical dependencies and the built models allow to determine the magnetic force by taking into account the parameters exercising influence during the performance of a specific task or for particular construction and at the same time allow to monitor the most significant parameters – speed of movement of the material and thickness of the layer of the treated product. This allows a more precise qualitative assessment of the parameters which help in the proper choice of the magnetic system of separators with permanent magnets.

B.4.9. Tatyana Dimova, Maria Marinova, Bohos Aprahamian, Georgi Zhelev, Increasing the efficiency of technological processes in lattice-type permanent magnet separators, XXII-nd International Symposium on Electrical Apparatus and Technologies SIELA 2022, 1 – 4 June 2022,Bourgas, Bulgaria

This article focuses on the construction of permanent magnet separators designed to separate ferromagnetic impurities from organic products. The field of application of permanent magnet separators is quite wide – from the separation of ores, recycling of waste and electro-technological materials to raw materials in the food industry, as well as separation of biological products in medical laboratories. This study is a continuation of a previous study by the authors

related to the separation of impurities from raw cocoa and sunflower seeds in prepackaging preparation. The article discusses the results of an experimental study of a lattice-type separator with a labyrinthine arrangement of permanent magnets, which is not static but has a rotating magnetic filter. The separating device is designed to separate ferromagnetic inclusions in organic products (e.g. rice, spelt, wheat, flour, starch, milk powder, etc.). A mathematical model of the magnetic filter has been made up and approach suggested allowing to determine some of the product parameters that have a significant impact on the separation process. For this purpose, an algorithm for determining the functional state of the mixture has been designed and implemented.

Separation with permanent magnets is a preferred method for processing a variety of seeds and flours in a number of organic industries. The involvement of permanent magnet separators has a number of advantages in many processing industries, which make it relevant and evolving. Separation with permanent magnets is cheap, it does not pollute the environment, it does not require complex management, it can work smoothly in extremely dusty environments and so forth. Separation with permanent magnets enjoys a wide range of applications in the field of food processing for it does not change other technological parameters, such as the temperature for example, which above certain levels (39ºC) leads to changes in the physico-chemical composition of organic raw materials.

The magnetic filter is the main module in the design of the considered separating device and determines the productivity and efficiency of the device. The design of the separator depends on the coefficients of pourability and the natural angle of repose of the material to be processed. These parameters are determined experimentally by laboratory tests. In some designs auxiliary permanent magnets are added, in others concentrators are implemented, in still others the trajectory of the processed product is changed by means of guiding barriers or rotating parts. In all designs the purpose is the same: to achieve a maximal degree of purification of ferromagnetic particles from the non-magnetic raw material with a minimal number of repetitive cycles. Separation is commonly carried out in low-magnetic inhomogeneous magnetic fields in order not change the biological structure of the processed mixture.

This study provides a basis for the design of permanent magnet separators and improvement of the separation efficiency of rice or various other cereals and seeds.

By analyzing the movement of the separated product in the separation zone under the action of gravitational and magnetic forces, the mechanism for reducing the segregation of grains from unwanted impurities is clarified. Simulations show that the effects of workflow length on separation characteristics are more obvious compared to the speed of separation of separated grains. The shorter duration of the working area in the production cycle and the lower speed of movement of the processed mass show much better results. The optimal parameters of the magnetic separation have been obtained after a thorough evaluation of the separation efficiency by an experimental method.

B.4.10. Tatyana Dimova, Bohos Aprahamian and Marin T. Marinov., Experimental evaluation of the purification of waste materials with belt type permanent magnet separator, XXII-nd International Symposium on Electrical Apparatus and Technologies SIELA 2022, 1 – 4 June 2022, Bourgas, Bulgaria

This paper presents a research on separator with permanent magnets designed for separation of ferromagnetic impurities from waste products. The advantages of magnetic separators with permanent magnets - environmental friendliness, energy saving and mobility determine the possibility for their further improvement and their efficient use. The research presented in the paper is essential for the optimal use of magnetic separators such as the correct calculation of the parameters of the magnetic system, the magnetic forces in the working area and the main parameters that affect the separation process.

Recycling of waste from various industries has always been a topical issue and a number of companies produce separators for waste products and compete in the market. This shows the need and relevance of continuous optimization of these separating devices. Permanent magnet separators are used when a large amount of ferrous inert is present in the waste stream. The type of separator discussed in the article, has the task to extract and remove ferromagnetic inclusions from the purified product, ensuring optimal level of purification. The separator is manufactured in Bulgaria by the company Elica Elevator and is called Belt magnetic separator, as it is installed above the conveyor belt, perpendicular to the flow of material to be purified. The separator attracts and captures the ferromagnetic particles from the flow and carries them away from the conveyor. The advantages of the separator are the following: mobility, does not need power supply, no complicated control, does not need an operator, has low cost. The separator can also be used in the early stages of refining technological materials such as glass, wood, plastic, slag after combustion and various other technical products.

The analysis of the results obtained from the experimental study of the laboratory prototype of the separator were compared with computer modeling and very good matches of the results were obtained. The obtained dependences are also successfully used in the design of other types of separating devices

The obtained results, based on the chosen approach for analysis, can also be used for solving other problems with separating of materials by help of permanent magnet separators. The chosen mathematical approach can be used for practical realization with sufficient accuracy and reliability.

Abstract of group Г.7. – Scientific publication in issues that are referenced and indexed in world renowned scientific information databases

Г.7.1. Streblau M., Aprahamian B., Simov M., Dimova T., The influence of the electrolyte parameters on the efficiency of the oxyhydrogen (HHO) generator, Proceedings of 18-th International Symposium of Electrical Apparatus and Technologies SIELA, 2014, pp. 225-228

The electrolysis of water is an electrochemical process wherein hydrogen and oxygen are derived. The resulting mixture of oxygen and hydrogen is called oxyhydrogen or Brown's gas. This paper present an experimental study of the regime of operation of an oxyhydrogen (HHO) generator depending on the parameters of the electrolyte - concentration and temperature by monitoring the amount of gas produced per unit time compared to the electricity input.

The rising demand and the limited supplies of non-renewable energy sources leads to significantly higher prices of these resources. For these reasons, even more relevant stands the problem for increasing the efficiency of energy conversion.

One of the main consumers of non-renewable energy sources are the internal combustion engines, which are characterized by relatively low efficiency. Lately more and more widely used is the oxyhydrogen known as Brown's gas. It is used as a supplement to the air mixture of an internal combustion engine. Thus is achieved a reduction of fuel consumption.

The generator of oxyhydrogen (HHO) represents an electrolyser, which is placed in an aqueous solution of an electrolyte (e.g., sodium or potassium hydroxide) and metal electrodes are immersed. Upon application of a voltage on the electrodes through the electrolyte passes electrical current, which leads to a directed motion of the positive H+ and negative OH- ions, respectively, to the cathode and anode. On the electrodes flow redox reactions leading the release of hydrogen and oxygen, respectively, on the cathode and the anode.

The outcome of experimental studies can draw the following conclusions:

- The dependence of the processing time from the concentration of the electrolyte has an exponential nature;
- The maximum of the MMW is registered at a concentration of the electrolyte close to 20%;
- The dependency of the flow rate of the generated oxyhydrogen from the electrolyte concentration reached a maximum at approximately 20% solution of the electrolyte.
- The obtained experimental results can be explained in the following way - increasing the concentration of the electrolyte leads to an increase of the current through it, which results in

higher values of the generated gas. This determines a greater gas flow passing through the apertures of the electrodes, which makes difficult the separation of gas bubbles from the electrodes to the output of the cell.

- Determination of the efficiency of the cell at higher temperatures by MMW is limited by the inability to account the amount of water vapor contained in the generated gas mixture.

Г.7.2. Slavova Y., Marinova M., Dimova T., Research on the temperature field of a combined device for cooking Zanussi, XV-th International Conference on Electrical Machines, Drives and Power Systems ELMA2017, 1-3 June 2017, pp 427 -430

Studying the thermal field of household appliances for food preparation is an important element of their design. Determining heat losses is directly related to the assessment of their effectiveness. For this purpose, mathematical models were developed based on the finite element method. Their adequacy was assessed by experimental studies. The data obtained enable the simulation of different operational modes and the further research in the field of their effective management.

The distribution of the thermal field is of crucial importance for the efficient operation of household electrical appliances used for preparation of food. The heat sources in these appliances are either constant or volumetric heat sources dependent on the temperature, convection and radiation. Therefore, the temperature distribution, temperature gradient, heat flow and heat losses are of great interest from a practical point of view. In the analysis of thermal processes, materials can either be orthotropic with constant thermal conductivity or isotropic with their thermal conductivity depending on the temperature. Due to the specifics of the installation of these devices, especially when they are designed to be inbuilt, experimental studies are quite inaccurate. For that reason, a theoretical study based on the finite element method is more convenient, and it can be modelled most easily in a programming environment FEMM 4.2. Despite its complex software and the difficulties that arise in determining the geometric dimensions and defining the blocks of the models, the program enables the creation of models for proper calculation of plane-parallel, axially symmetric, stationary and quasi-stationary fields, as well as construction of their images and definition of their parameters. It has been ascertained that the development of a computer model in programming environment FEMM 4.2. can fully resolve the problem of developing expensive and complex models. This program enables the development of actual-size models of devices.

Based on the results obtained and the relatively accurate models (errors from 0.8 to 8.8%), the following main conclusions can be drawn:

1.The differences in the temperatures of idle mode and loaded mode in the heating zones are 4.78 %. This requires that the heater should be protected from prolonged idle mode. 2. The differences in the temperatures of idle mode and loaded mode in the zone of the free pyroceramic cooktop are 1.85 %. The high temperature in idle mode also determines the need to incorporate a sensor of residual temperature for all cooktops.

3.The oven's idle mode is extremely heavy, and this was the reason for it to be studied in separate, on its own. The obtained temperature of 524,8 degrees accounts for high losses. In

order to increase its efficiency, it is advisable to recommend recipes with minimal preheating time or to develop new ones with direct start of cooking, without any preheating. Special operating modes could be developed with recommended operation parameters controlled by a programmer device.

The results obtained indicate not only a possibility for analysis of the fields in idle mode or under load, but also for optimization of the insulation in the zone encompassing the heating cooktop and the oven. The variants developed and the results obtained enable improvement of the system's operational specifications and further research in the field of effective management of the system.

Г.7.3. Aprahamian B., Marinova M., Dimova T., Assessment of the influence of the technological parameters on the magnitude of the electrical contact resistance of current-carrying busbars with magnetron sputtered thin coatings, Proceedings of 20-th International Symposium of Electrical Apparatus and Technologies SIELA, 2018, pp. 36 - 39

In many cases, operating conditions for low and medium voltage busbars are characterized by extreme electrical, cyclic and temperature loads and the presence of chemically active environment. The requirements for busbar materials are increased due to high loads and high operating temperatures. The use of a suitable coating and a method for its application can significantly increase the durability of the current-carrying busbars while maintaining their basic electrical and thermal characteristics. This, however, also alters the magnitude of the electrical contact resistance in the contact area. Interesting from a practical point of view is finding the optimal combination of technology, coating and magnitude of the electrical contact resistance, which is also the subject of this research.

Current-carrying busbar systems are widely used in practice. They are characterized by specific configurations and connections that determine the reliability of the equipment. The presence of contact connections between them is a prerequisite for increasing the resistance and overheating of the electrical equipment. One of the problems in studying the heating of the current-carrying busbars is the setting of the electrical contact resistance values. It is known that it depends on complex physical processes, many of which are random in nature. Often, different coatings on the busbars are also used in practice. Their purpose is to improve the performance in the contact area, but this often results in an increase in the electrical contact resistance and hence in overheating. An effective contact compound is what is characterized by very low contact resistance, both in the beginning and the end of its service life, but at the same time it has good wear and corrosion resistance. The aim is to reduce the electrical contact resistance and increase the reliability of the contact compound during its operation, which in some cases are contradictory goals. The purpose of the present research is to evaluate the influence of the technological parameters of the magnetron sputtering process on the magnitude of the electrical contact resistance of current-carrying copper busbars.

The obtained experimental results and the simulated computer models developed on their basis allow determining at the design stage of the contact connections an optimal combination of parameters of the technological processes, leading to minimal electrical contact resistance.

The resulting simulation models are non-linear and it is difficult to uniquely assess the complex of influencing technological parameters. By using a subsequent optimization procedure,

it is possible to achieve the precision of the influence of the factors and the determination of a combination of technological parameters ensuring a minimal resistance.

Enriching the results database with additional technological regimes and coatings, the proposed approach allows the development of a comprehensive program to improve the performance of the current-carrying busbars.

Г.7.4. Aprahamian B., Marinova M., Dimova T., Assessment of the influence of magnetron sputtered coatings on the electrodynamic forces of current-carrying busbars, Proceedings of 20-th International Symposium of Electrical Apparatus and Technologies SIELA, 2018, pp. 32 - 35

In current-carrying parts of electrical apparatus, under certain conditions, large currents are transferred, which also define large electrodynamic forces striving to distort the current contours. The most severe is the short-circuit regime where the electrodynamic forces are proportional to the square of the short-circuit breaking current. As a result of their action the temperature of the elements increases, the mechanical strength decreases and a very heavy mechanical load regime is formed. This also determines the increased requirements for the materials for current-carrying busbars. Interesting from a practical point of view is the question of how a given coating affects the magnitude of the electrodynamic force. The use of protective coatings on heterogeneous materials can result both in the modification of the surface layer material which enhances the performance of the workpiece and in the formation of some new composite materials having both high strength and sufficient plasticity as well as increased wear and corrosion resistance. This leads to improvement of some of the operating parameters in the contact area of the current-carrying busbars. It is also important to assess the influence of the coatings on the magnitude of the electrodynamic force, which is also the subject of this research. The obtained experimental results and the developed simulation computer models on their basis allow to evaluate the effect of the type of coating on the magnitude of the electrodynamic force. They allow to estimate the magnitude of the electrodynamic force also in the short-circuit regime at the design stage of the device. Due to the experiments realized only at currents up to 100 A, the conclusions are valid only for the defined ranges of the technological process parameters. When enriching the results database for additional technological regimes and coatings, the proposed approach will allow the development of a comprehensive program to improve the performance of current-carrying busbars.

Г.7.5. Marinova M., Aprahamian B., Dimova T., Andreev P., Forecasting the Production of Electrical Energy From Photovoltaics, XVI-th International Conference on Electrical Machines, Drives and Power Systems ELMA 2019, pp 585 – 589

The production of electricity from renewable energy sources (RES) increases every year. For Bulgaria, a serious relative share is that obtained from photovoltaics. Because of its volatile

nature, however, it creates a number of problems. One of the most important is related to its forecasting. Although there are different forecasting methods, much is currently being done to increase their reliability and accuracy. This determines the high priority of the present research work.

The main focus of the energy policy of the Republic of Bulgaria is sustainable energy development. The near target by 2020 is to achieve a 20% share of renewable energy sources (RES) in energy resources. In recent years, because photovoltaic technology prices have decreased, solar power takes a major part of total consumption. It is also a fact of priority that the Bulgarian climate and the duration of the sunny day make our country suitable for its use. However, the energy obtained is volatile and has a random character, depending on the dynamics of atmospheric and climatic processes. Considering that for now this energy is complementary, it is very important to estimate the quantity that can be produced in some future period. In this connection, the aim of this publication is to present a theoretical approach to forecasting the production of photovoltaic electricity based on data from a system for automated collection of local information (meteorological and technological) by introducing correctional model coefficients derived from based on stochastic models.

With the help of the theoretical approach thus developed, based on local data about the solar radiation and the panel temperature, as well as the specific meteorological data, guaranteeing a high level of reliability of the base information, the production of photovoltaic electrical energy can be predicted with high accuracy. The model is going to be expanded with taking into account the impact of the AQI air quality index. It is based on the measurement of dust particles (PM2,5), ozone and nitrogen dioxide in the air. Given the fact that the pollution with dust particles would also affect the production of electrical energy, this factor may prove to be of crucial importance. From a theoretical point of view, the extension of the range of variation of the UV index is also of research interest. It is a number (1 to 12) indicating in relative units the maximum amount of solar ultraviolet radiation falling on the earth surface at a specific location at a given time. In the suggested mathematical model, it is within the range of 0-1. In the spring, summer, and autumn, however, it reaches values of up to 10 and this also greatly affects the magnitude of solar radiation, the temperature on the module, and hence the energy produced. The accumulation of an additional database will allow for more accurate correction functions, especially with regard to the sunrise and sunset time range. The approach can be applied to both autonomous and other systems.

Г.7.6. Dimova T., Investigation of Digital Protection Relay For Three-Phase Induction Motor, XVII-th International Conference on Electrical Machines, Drives and Power Systems ELMA 2021, 1-4 July 2021 Sofia, pp 543-546

The article considers a simplified circuit solution for protection of induction motors through a device which provides reliable protection of a wide range of faults leading to unwanted interruptions of a variety of technological processes. The design of the electrical device is classical in combination with an electronic unit for monitoring the electrical parameters of the circuit. The operation of the protective device has been tested, and the results compared with similar devices.

It is well known that the three-phase induction motor is extensively used in all spheres of industry and life. This is so due to its many advantages. The protection and control of the induction motor are constantly being improved while many authors have focused on these problems. The recent years trends have necessitated a smooth transition from the use of neural networks through optimization of classical methods, thermography, online protection methods to the most popular microprocessor control and protection.

The dynamic changes in various industry branches and the economic crisis over the last year forced many small and medium-sized companies to look for ways to achieve, through minimum changes and costs in their electric drives, a maximum protection of their equipment without additional expenses. This proved to be a starting point for finding the optimal design of an electrical device which can meet the requirements of a real task set by practice. Of course, there exists multifunctional, completely electronic, fast and precise electrical protection, which provides online monitoring and meets all modern standards, but the high cost of this equipment makes investors continue to look for new circuitry solutions enabling reliable protection against the most common causes of internal and external damage to their equipment.

All this is also due to the growing demands in recent years to increase the reliability of electric drives; therefore, the issue of ensuring reliable control of electrical equipment and, in particular, of the electric induction motors, is becoming more and more relevant. This refers mostly to the proper selection of switchgear. Providing a reliable control implies having a good knowledge of the principle of operation and technical characteristics of modern electrical devices.

The focus of this study is on creation of a stand for testing the operation of a digital motor protection relay in order to find the best combination of classical electrical devices and an electronic unit for protection and control, which could ensure the simplest circuitry solution and minimum costs for its implementation. To achieve this goal, the following has been carried out:

 Making a block diagram with the main protective functions of an electrical device, including an electronic unit with a simplified architecture designed to control and protect induction motors

with a wide range of nominal power.

 Selecting a circuitry solution for control of an induction motor.

 Creating a stand for testing a digital protective motor relay.

 Conducting tests on the protective functions of the device.

 Summarizing the results from the conducted tests, determining the features at specific settings of the relay, and comparing the results with the characteristics of the electrical protection relays of leading companies.

The suggested model of an electrical device deals with the settings for protection against the most common causes of stopping the production processes as regards the induction machines. This model has been studied and implemented in laboratory conditions. It helps to provide protection with minimum switchgear and at minimum costs. The results confirm that the realized settings provide a very good switch-off selectivity. If the first setting fails, then the second one starts off, and the operating time is extended, but without damaging the protected object. The results of the experiment and the simulation (mathematical model) coincide with each other, which confirms the accuracy of the results. The electromagnetic relay with a digital motor

protection element (Micro Processor Control Unit) operates with high reliability and high precision. Protective functions, such as: phase loss, phase reverse, power disbalance, power failure, blocked rotor and short circuit protection are fully achievable without the need to use many in number and also expensive modules for monitoring and protection, equipped entirely with electronics.

Γ.7.7. Marin Todorov, Maik Streblau, Marin Marinov and Tatyana Dimova, Analysis of The Transient Process in a Direct Start-up of an Induction Motor, by Use of COMSOL Multiphysics, ICAI 2021 International Conference "Automatics and Informatics'2021", pp

This article presents an approach for modeling an induction motor with a squirrel cage rotor, using Finite Elements Method (FEM), in COMSOL Multiphysics software. A transient process is simulated for direct on-line startup at no load condition. For this purpose, an experimental and simulation tests have been carried out. There are obtained and analysed oscillograms of the currents and the electromagnetic torque.

Induction motors with squirrel cage rotors are the most widely used machines in the industry. This is mainly due to their simple design, easy maintenance, and a number of other advantages. The possibility to analyze the processes in induction machines is an important step in their design and diagnosis, and the use of the finite element method (FEM) for this purpose has gained popularity in the recent years. One of the most difficult modes in induction machines is the direct on-line start-up. For its implementation, the following conditions must be met: - The motor must provide the required start-up torque. - The supply of the power grid must be sufficient.

The transient process when starting an induction motor is a complex process in which part of the electromagnetic energy is converted into mechanical and another part into heat. In recent years, some authors have shown interest in simulating the start-up process using FEM. Modelling these processes requires the synthesis of a multi-physical task. One of the popular software products for the realization of such models is COMSOL Multiphysics. The aim of this article is to analyze the transient process in direct start-up of an induction motor through a 2D model realized in COMSOL Multiphysics.

The maximum error at the time of start-up is 20% After the increase in the revolutions of the machine, the relative error between the currents obtained from experiment and model is less than 10%. Deviations are observed in the values of the electromagnetic torque between experiment and model, the relative error at the initial start-up torque being less than 5%, and after the increase in the revolutions of the machine and reaching the idle mode, the relative error from the average values of the electromagnetic torque compared to experiment and model, reaches about 10%. The indicated deviations in the studied parameters are due to the accepted assumptions in the description of the multiphysical model. The differences that are found in the oscillograms of the electromagnetic torque between experiment and model are also due to the method used to calculate the electromagnetic and inertial torques, as well as the choice of method for discretization of the areas. According to the obtained comparative results, the presented model is adequate to the conducted experiment. This determines its feasibility for application in conducting more in-depth studies of the transient process with direct startup of an induction motor with a squirrel cage rotor.

Г.7.8. Dimova T., Experimental Determination of The Factors Affecting The Technological Process of Separation With Permanent Magnets, XVII-th International Conference on Electrical Machines, Drives and Power Systems ELMA2021, 1-4 July 2021 Sofia, pp 526-529

A separator with permanent magnets has been studied. The design of the separator and the location of the permanent magnets are described. Data are obtained experimentally on the magnetic induction along the longitudinal and transverse axes of the magnetic separator. Attention is paid to the factors affecting the separation process. The experimental results are processed by statistical modelling.

This research work studies a separator with permanent magnets for purification of products from the electrotechnical industry (magnesium oxide and quartz sand) through separating ferromagnetic particles from them. Since the materials to be separated are non-magnetic, their relative magnetic permeability is equal to one, and the permeability of the ferromagnetic inclusions is assumed to be 1000 H/m. Magnetic separators with permanent magnets are modular systems designed for high-quality separation of ferromagnetic and low-magnetic particles from bulk materials and liquid suspensions moving along a belt conveyor or another type of conveyor facility. Separators with permanent magnets significantly reduce the cost of the technological process. The emergence and constant development of new strong permanent magnets makes their application in technological devices for various purposes more relevant than ever.

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1. Through statistical modelling the percentage-based effect of the considered factors has been determined as well as the complex effect of the different interactions between them. The effect of the selected factors is analysed as well as the possible individual combinations for a special case of separation with permanent magnets.

2. The obtained nonlinear regression equation has a relative error of 9%, which allows us to conclude that the model is reliable. It can be used to calculate the optimal values of the factors for setting the separator, such as: thickness of the treated product, product feed rate, number of separations, etc. Regression equation confirms the theoretical expectation, proving that it is possible to reduce the volume of experimental and computational work.

3. Numerous experimental studies of the interactions in the magnetic separator and the derived mathematical models of the process of magnetic separation describe with high accuracy the real processes. For that reason, studies of the dynamic behavior in the process of operation of a separator with permanent magnets, when designing facilities or developing separation methods and techniques, are based on empirical dependencies determined in a series of experimental studies of real systems.

Г.7.9. Dimova T., Modeling the magnetic field inside a hand separator with permanent magnet, XXII-nd International Symposium on Electrical Apparatus and Technologies SIELA 2022, 1 – 4 June 2022,Bourgas, Bulgaria

This article focuses on a mechanism with permanent magnets designed for separation of ferromagnetic impurities from bulk and determining of magnetic permeability. It is a study of the picture of the magnetic field inside a mechanism with permanent magnets which is used for laboratory work with students. Attention is paid to the characteristics of the field intensity and suggest an approach to determine the magnetic forces.

In laboratory practice, in order to separate minerals by their magnetic permeability, we normally use devices whose magnetic systems are either constant magnets or electromagnets. The constant magnets are made of ferromagnetic alloys which have a large residual induction and considerable coercive force, such as the alloys FeNiAlCo and FeCoW and others. The whole purpose of this work is to model the picture of the magnetic field in a laboratory separator with permanent magnets, designed to separate bulk materials according to the magnetic permeability of individual substances and to prove the adequacy of the model via comparison with characteristics obtained experimentally. To achieve this aim, we have made and studied an experimental sample of manual magnetic separator with constant magnet. The field of application of the permanent magnet separator is for training students who study issues related to the theory of magnetic fields and their application in electrotechnological processes. The advantages of this device are: simple design, reduced overall dimensions, economy of electrical energy, easy to maintain.

The theoretical and experimental approach proposed here allows to visually, quickly and easily determine not only the distribution of the magnetic field in the working area of the separator under study, but also to separate a given mixture according to the magnetic permeability of the separated substances which compose it by the weight method. This is achieved by acting on particles with different magnetic properties with magnetic forces of different sizes.

The simplicity of the method and design of the magnetic separator make it very convenient for the separation of highly magnetic ore mixtures and for laboratory purposes to pre-separate the materials according to their physical properties. The method does not aim to determine the permeability of substances as precisely as possible, but to provide students with the opportunity to separate nonmagnetic from magnetic materials into different numbers of fractions at different magnetic field settings as well as to get acquainted experimentally with the basic laws of magnetism.

Г.7.10. Marinov M., Zelev G., Streblau M., Dimova T., The Effect of the Load on electrical parameters of a Three-phase Induction Device, XXII-nd International Symposium on Electrical Apparatus and Technologies SIELA 2022, 1 – 4 June 2022,Bourgas, Bulgaria Под

Induction heating is a method for contactless heating of electrically conductive materials. The process is easy to control, energy-saving and transmits high powers free of carbon emissions. The main problem in the three-phase induction devices with radial arrangement of inductors is the presence of a rotating magnetic field. The device suggested in the present work eliminates this problem, and the present work investigates the effect of the load on the parameters of the electric energy. The magnetic field of most systems used in practice has a complex spatial structure and does not yield to accurate mathematical analysis. Various methods

with a simplified field structure have been used to determine magnetic conductivities. In the present work, a method with probable (expected) paths of the magnetic flux developed by Roters was used. The essence of this method consists in replacing the actual distribution of the field with an approximate one, where the flux is considered as a set of power tubes (geometric figures) with a simple but sufficiently plausible shape. In order to reduce the complexity of this method in the calculation of magnetic conductivities, the present work uses software product PTC MathCad, which has the great advantage of giving much more accurate results than electronic spreadsheets.

The present development is a continuation of of previous research, which describes the electromagnetic processes in a three-phase induction device with split phase, operating in the under-load mode. The theoretical study covers:

 calculating the electromagnetic parameters in the under-load mode of the three-phase induction device: magnetic resistances of the air gap and the disk, magnetic conductivities, losses from eddy currents and hysteresis, and losses in the coils;

 compiling a system of equations to describe the electromagnetic processes in the device;

calculating the currents in the three phases and the neutral conductor, and the active power at different thickness of the ferromagnetic steel discs used as a load.

From the studies conducted and the summarised comparison, it is evident that the increase in the thickness of the disk (the load) results in decrease in the currents in the three phases, with an 8,5-mm-thick load being optimal for the studied device. This thickness ensures currents of minimum values and maximum active power released in the load. The fluctuations in currents and active power can be explained by the different magnetic permeability of the material of the disks.

Abstract of group Г.8. – Scientific publication in non-referenced scientific peer-reviewed jornals or in peer-reviewed volumes

Г.8.1. Dimova M. Tatyana, Ivanov K. Atanas, Dimitrov I. Dimitar, Modeling and study of processes inside a drum electromagnetic separator, TEHNONAV'2006, The 5th International Scientific Conference On naval technologies, 19-21 May 2006, Constanta, Romania

Owing to its numerous advantages, magnet drum separator finds wide application in industry nowadays. This raises some questions related to the theoretical and practical applications of these methods of magnet field treatment. In order that the quality and effectiveness of their application be enhanced, the existing methods of research and improvement of the constructive solutions need to be made preciser. The solution of the above questions requires application of new mathematical models and computer methods of research. This piece of research studies a magnetic device - drum separator with electromagnetic stimulation. The described mathematical model has been realized by the method of finite elements. In support to the theoretical research, an experiment has also been conducted in order to assess the adequacy of the model.

The model thus realized allows separation of ferromagnetic mixtures from non-magnetic. The experimental study of the magnetic field in the area of separation at various electromagnetic excitation.

The results could be used for optimization of the separation process for ferromagnetic materials with different electromagnetic permeability. A mathematical model has been developed for studying the picture of the magnetic field with various values of excitation. The results thus obtained coincide with the experimental ones, which proves the adequacy of the model. The mathematical model could be used to study larger electromagnetic systems for preliminary assessment of the technological possibilities for separation of loose materials.

Г.8.2. Димова Т., Иванов А., Славова Я., Влияние на някои конструктивни параметри върху електромагнитната сила в електромагнитен барабанен сепаратор., УНИТЕХ 2007 Международна научна конференция, Габрово, България.

This piece of research studies a magnetic device - drum separator with electromagnetic stimulation. The described mathematical model has been realized by the method of finite elements. In support to the theoretical research, an experiment has also been conducted in order to assess the adequacy of the model.

One of the separation methods for bulk materials is by using electromagnetically excited separators. Their advantages are that a stronger magnetic field can be obtained and its value adjusted. The main structural unit of the studied separator consists of electromagnets with opposite alternating polarity, between which concentrators are additionally located. The separator is designed to separate ferromagnetic inclusions from non-magnetic ones, and the processed product is affected by mechanical and magnetic forces, so that particles with different magnetic properties receive different trajectories of movement.

The purpose of the study is to determine the influence of some design parameters on the magnetic induction, force and distribution of the magnetic field on the surface of the separator, based on a computer model and experiments conducted on an operating electromagnetic separator.

Г.8.3. Dimova T., Ivanov A., A possibility of modeling the magnetic field inside a laboratory separator with permanent magnet, EE'2006, Международна научно-техническа конференция Електроенергетика 2006, 5-6 Октомври 2006, Варна, България, стр. 151 - 159

This article focuses on a mechanism with permanent magnets designed for separation of ferromagnetic impurities from bulk and determining of magnetic susceptibility. It is a study of the picture of the magnetic field inside a mechanism with constant magnets; attention is paid to the characteristics of the draught and suggest an approach to determine the magnetic forces.

The results obtained from the experimental studies of the magnetic induction along the radius r of the constant magnet, at different distance and the size of the magnetic force are given. The comparison between the results obtained from the experiment and the computer modeling coincide entirely thus proving the adequacy of the model, and the effective performance of the

separator as well. The theoretical approach proposed here allows a visual, fast and easy way to determine not only the magnetic susceptibility of the separated substances, but also the distribution of the magnetic field in the working area of the separator being studied.

The simplicity of the method and the construction of the magnetic separator make it very convenient for determining the magnetic susceptibility of highly magnetic ore mixtures and is used for laboratory purposes for a preliminary separation of the materials as per their magnetic susceptibility.

Г.8.4. Nikolay Hristov, Maik Streblau and Tatyana Dimova, Online System for Monitoring and Analysis of the Operation of a Small Photovoltaic Plant , Vol 5 No 1 (2021): Annual Journal of Technical University of Varna

This article proposes an integrated system for monitoring and analysis of the operation of a small photovoltaic plant with the possibility of remote access via the Internet. The system has been built on the territory of Varna Technical University and is based on a mini computer Raspberry Pi 3B + using a Linux operating system. The monitoring is performed by keeping track of the environ-mental parameters and the input-output parameters of the photovoltaic inverter. Data are presented for a period of three months: October 1, 2020 to December 31, 2020. The results are visualized by appropriate graphs, demonstrating the change in the observed indicators, both for the entire speci-fied period and for a randomly selected day.

Climate change, rising fossil fuel prices and the need to ensure energy diversification and security in recent years have led to increased interest in renewable energy sources (Solaun & Cerda, 2019). Most of these sources have an uneven distribution throughout the day, month or year (Misak & Prokop, 2016), which poses a serious challenge for their integration into the electricity grid (Oskouei & Mo-hammadi-Ivatloo, 2020). Given this feature, energy production forecasting is performed by taking into account the observations both on the initial parameters of electricity, immediately before its transmission to the electricity grid (Inman et al., 2013), and on the environmental parameters related to energy con-version of the respective renewable energy source. In view of the above, many photovoltaic plants that convert solar energy, as well as systems that convert energy from another type of renewable source, require the use of a monitoring and data collection system (Drews et al., 2007), (Farihah et al., 2015), (Tina & Grasso, 2014), (Madeti & Singh, 2017).

The purpose of this article is to present an integrated online system for monitoring the parameters of a photovoltaic system using the Sunny Sensor Box measuring system and the Sunny Boy grid- inverter.

The monitoring system is an integral part of any photovoltaic plant. It enables a quick and easy identification of a problem, and the availability of archival data helps to ensure quality analysis and allows accurate diagnosis of the condition of the photovoltaic plant through remote access.

The analysis of the obtained results shows stable operation of the photovoltaic system, as the tem-perature during operation of the inverter remains relatively low, even at maximum load. The reactive power during operation of the inverter is close to zero, and the grid frequency is stable and meets the tolerances specified in the standards.

The presented monitoring system allows it to be implemented to photovoltaic systems not only of a grid type but also of an autonomous or hybrid type.

To ensure the completeness of the research, it is necessary to collect data during one year at least. This would allow the data to be integrated into software products for modelling and analysis of the operation of photovoltaic systems for the respective location where the research is carried out.

Г.8.5. Maik Streblau, Marin Todorov and Tatyana Dimova, A Study of the Impact of Squirrel-Cage Rotor Faults on the Stator Current Signature, Annual Journal of Technical University of Varna, Vol.5 Issue 2 (2021)

The present paper considers the impact of the degree of damage to a squirrel-cage rotor of an induction motor on the spectrum of the stator current. The study is based on the motor cur-rent signature analysis. Performed, for this purpose, were scientific experiments on eight samples of squirrel-cage rotors, seven of which with pre-inflicted faults using Dynamic Motor Analyser. The obtained results are herein presented in graphical and tabular form and are further compared with the ones acquired from an induction motor with an intact rotor winding. It can be clearly as-certained that the larger the number of damaged rotor bars, the more significant the increase in the current amplitude as correspondent to the side band amplitude.

A case study of an approach for detecting rotor cage defects based on motor current signature anal-ysis was presented in the current paper. Based on the results described above and the analysis per-formed, it can be clearly concluded that with an increase in the number of damaged rotor bars, a sig-nificant increase occurs in the current amplitude corresponding to the frequency f1(1-2s). The highest SBA values are obtained when the broken rotor bars are next to each other.

In order to obtain correctly achieved measurement results through the applied method, it is neces-sary to provide a static load during the experiment with a value of not less than 50% of the rated motor power and with the range of the current sensors being as close to the measured values as possible.