



MECHANICAL ENGINEERING AND MACHINE BUILDING

INFLUENCE OF ROLLING SCALE PROCESSING PARAMETERS ON MORPHOLOGY OF REDUCED IRON POWDER PARTICLES

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The use of various modes of rolling scale preparation and technological regimes of its reduction to obtain iron powder is discussed, and some of the results of original research in this field are given. The main aim of this research is to obtain a reduced iron powder with the highest level of physical and technological characteristics. The use of modern diagnostic properties of materials allows scientists to collect and analyze information received from experts around the world with the help of decision support in the field of powder materials with physical and technological characteristics of the unique complex. The prerequisites for using the reduction method for the processing of rolling production waste are discussed in the article. The complex of physical and technological properties of iron-based powder materials for production of sintered products for various applications is investigated. The presented methodology for assessing the properties of materials using advanced methods of analysis allow to obtain real information about complex of performance characteristics of iron-based powder materials. The patterns of joint influence of technological process factors on the form and size of synthesized iron powder particles are defined. A feature of the development is a comprehensive accounting and mathematical presentation of influence of scale preparation parameters (grinding feed rate, temperature and time of isothermal holding at reduction) on the surface shape and the size of the reduced iron powder particles in order to detect the presence of synergy of these factors. The regularities in the future will help to develop mathematical models to quantify the degree of influence of technological factors on the structure, physicochemical and operational properties of powder materials.

The research results can be applied by experts in metallurgy and mechanical engineers to develop new resource recovery technology of rolling production waste, as well as to create new kinds of sintered powder materials with improved performance characteristics.

Keywords: recycling, rolling scale, iron powder, morphology of the particles, sintered powder materials.

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ELECTRICAL ENGINEERING AND INDUSTRIAL ELECTRONICS

ANALYSIS OF THE POTENTIAL FEATURES IN MULTICOMPONENT CERAMIC COMPOSITES BASED ON THE REFRACTORY ANOXIC COMPOUNDS (PART 2)

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The physical nature of thermoelectric phenomena in ceramic composites based on refractory anoxic compounds is examined in the article as the object of research. In the current operating conditions, the disadvantages of this object are a big response time, which presented in that the produced functional devices do not sensitive to the sudden peak changes in the temperature.

The study of thermoelectric properties was conducted by heating the entire sample. It was placed in the oven, increase the speed of heating which is supported within 4 deg/min with an accuracy of $\pm 0,2\%$. The temperature of the oven was parallel controlled by platinum-platinum-rhodium thermocouple.

For the first time proved that for maximum Seebeck coefficient, metallic inclusions should have an elongated cylindrical shape and volume. Percolation threshold should be about 2, and fractal dimension of the cluster should be about 2,4. Obtained

values contradict the Skal's theory and need further research. It is proved that using the effect of accumulating and storing charge during their release, it can increase conductivity without reducing thermoelectric ability of the couple, which in turn will increase the thermoelectric Q-factor.

These research results can be used for the manufacture of highly efficient thermoelectric converters.

Keywords: percolation theory, Skal's theory, Seebeck effect, hafnium carbide, Seebeck coefficient, metallic inclusions.

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DEVELOPMENT OF EFFICIENCY IMPROVEMENT METHOD OF PHOTOVOLTAIC CONVERTERS BY NANOSTRUCTURIZATION OF SILICON WAFERS

page 16–20

The object of this research is the process of preparing silicon wafers for further use as the main component of solar panels.

One of the problems in this process is the degradation of silicon in service and high rates of reflection coefficient, which greatly affects the PVC performance.

The layers of porous silicon were formed by electrochemical etching in a solution of hydrofluoric acid at room temperature. This method is the most common for making porous semiconductors, due to the simplicity and low cost.

The technological modes of obtaining porous silicon layer were determined. The porous silicon was formed by electrochemical etching in a solution of hydrofluoric acid. Nitrogen passivation was used for stabilization of the properties. It was found that the thickness of the porous layer correlates with the etching time. The porosity shows a nearly linear dependence on the current density. The obtained results allow to state that porous silicon is a promising material for creation of solar cells on its base.

Keywords: photovoltaic converters, porous silicon, reflection coefficient, electrochemical etching, nanostructures.

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SURGE ARRESTER MODELING USING MICRO-CAP

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SIMULATION OF BATTERY DISCHARGE CONTROL SCHEMES

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The main approaches to building control schemes and control of lithium-polymer batteries are analyzed in the article. Although considered possible element base is very diverse, but it is not always possible to accomplish the task. Instead, a study proposed two schemes of controller building of battery discharge level. The basis of their work is the method of controlling the accumulator battery (AB) level by measuring the voltage. The first scheme enables disconnection of the power supply from the system (and subsequent connection of backup AB) in achieving a given level of discharge, preventing recharging and previous AB breakdown. The second scheme allows to control multiple discharge levels (using the principle of LED column) by establishing four comparators, thus reflecting the whole discharge cycle.

The methods of analytical research of existing capabilities of building ABs control systems for unmanned aerial vehicles and simulation techniques on the basis of Multisim 12.0 program are used during research.

Implementation of the simulation model allows visually assess the performance of the proposed schemes and pay attention to possible ways of their improvement and further development. The results extend the design and use of unmanned aerial vehicles that are powered by portable power sources – Lithium-polymer batteries.

Keywords: accumulator battery, chemical power supply, control system, charge level indicator.

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In this paper the results of circuit simulation of metal-oxide surge arrester using the Micro-Cap evaluation version are presented. Nowadays a surge arrester is the most common type of overvoltage protection device and appropriate modeling of such power system's component is a significant task. Moreover, metal-oxide arresters have dynamic characteristics that are significant for studies involving lightning and other steep-front surges.

Two methods of metal-oxide surge arrester modeling are described. The main innovation introduced by the paper lays in the usage of analog behavioral voltage-controlled current source and current-controlled voltage source for non-linear varistor modeling.

The residual voltage test results obtained by the manufacturers were compared with the results of simulations performed with the Micro-Cap evaluation version. Both proposed models fits with a high accuracy the arrester performances reported in the data sheet. Two different lightning current waveforms were used. One of them has its first derivative equal to zero at the initial moment of time and other one does not. For both waveforms maximal residual voltages obtained in the simulation are almost equal.

Effectiveness and simplicity of use make the proposed way of modeling a useful tool for insulation coordination and lightning protection studies.

Keywords: schematic simulation, surge arrester, residual voltage, lightning protection.

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INFORMATION TECHNOLOGIES

RESEARCH OF KEY APPROACHES TO RESPONSIVE WEBSITE DEVELOPMENT AND THEIR PRACTICAL APPLICATION

page 31–35

The perspectives of responsive approach in web development in the design and layout implementation by web developers are analyzed. It is due to, primarily, a significant increase in mobile internet traffic and increase the diversity of electronic devices. The optimal responsive approach compared with the development of certain versions of websites for different devices is analyzed. It is shown that responsive approach provides greater website support by all devices. This is achieved thanks to its particular advantages, including the use of HTML and CSS code to display a website on all devices and adapting the content to the width of the browser. Definition of the term «responsive web design» by different authors and scholars are considered. The basic components using this approach are theoretically described and practical examples are given. In particular, the use of relative values for a given width of the container and child elements, use of media queries for laptops, tablets and mobile phones. «Mobile-first» approach is investigated as an independent web development philosophy and at the same time, as an integral part of responsive website page layout, its advantages and disadvantages. An example for the analysis of website responsibility was selected resource of the American newspaper «The Boston Globe».

With a significant every year growth of screen resolution the issue of JPEG format feasibility for displaying graphics of the website is became actual. Therefore, the analysis of SVG format is carried out. Graphics clarity isn't lost for it and the output file size much smaller as a result. It is shown that this is achieved through describing two-dimensional graphics in XML and using three types of objects: shapes, images and text.

Despite the fact that today there is access to many popular frameworks that are already implemented responsibility, many companies continue to develop multiple versions of websites for different devices. This significantly increases the resource costs for their support, and as a result they are available for a small portion of users.

Keywords: web site, Internet, responsive web design, site development, responsive web development, responsive page layout.

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INTEGRATION OF PROJECT MANAGEMENT PROCESSES AT THE PLANNING STAGE TO THE CORPORATE BUSINESS PROCESSES

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The problem that faced the project manager and project participants in the implementation is that the processes of traditional project management methodology aren't integrated into the existing system of business processes. The reason for this is the lack of uniform generally accepted project management processes that must be performed on the stage of project planning and use of non-adaptive processes of traditional project management methodologies. The object of the study is the project management processes at the planning stage.

It is proposed to integrate a project management processes to business processes at the planning stage. In description of the project management processes in the form of business processes, efficiency of formation of all the processes required for implementation of the planning phase of the project is increased that allow schematically show not only their sequence, but also incoming and outgoing documents required for the proper implementation of the processes, assign responsible in each process and describe the procedure execution processes.

Research results are described functions, duties and powers of the roles in the project, defined processes at the planning stage of the project; described procedures for the implementation of each process; described template of outgoing process documents. Research results can be used to form the Rules of project management.

This approach to description and organization of management processes at the planning stage allows to systematize the actions of the head of project management and management of the company, in turn, unify a single generally accepted procedure of project implementation, objectively assess the quality of the

project management by the project manager, achieving the objectives of the projects.

Keywords: role structure, project planning, project management processes, business process modeling.

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IDENTIFICATION OF CONTEXT-WORKFLOW DEPENDENCIES IN KNOWLEDGE-INTENSIVE BUSINESS PROCESSES USING LOG ANALYSIS

page 43–49

Multivariate knowledge-intensive business processes that change at runtime on the basis of knowledge are considered. For more effective implementation of the process performers correct the course of its action with the help of their personal knowledge and experience. The dependencies that reflect the link between the execution context of the process actions are used. To improve the process control efficiency it is necessary to formalize the context-sensitive knowledge of artists and include them in the process model. Context states, as well as the sequence of process actions

are recorded in the log of information system. This presents an opportunity to highlight the links between the context and the process based on log analysis. The method of selection of context-procedural dependencies of knowledge-intensive business process is proposed. This process involves the identification of repetitive sequences of events that reflect the process execution, as well as state of context artifacts and the relationships between artifacts that lead to the implementation of these actions. The method improves the efficiency of process control of knowledge-intensive business processes by supplementing the process mode by identifying dependencies.

Keywords: knowledge-intensive business process, process mining, process control.

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ANALYSIS OF CYBER HAZARD IMPACT ON OCCUPATIONAL SAFETY

page 49–60

The problems of the computerization process for production, technology and human activity in the context of the necessity and possibility of cyber security and occupational safety are considered. An increase of Ukraine population dependence and other countries from the cyberspace is shown. Influence of cyber technologies manifested in computer programs, use of social networks, computer games and other. In the last decade there are cyber competitions of international level. The world was divided into specialists in IT technologies, advanced users, casual users and beginners. There are

practically no people who would not know about computers and the need for their application. All banks transferred calculations through ATMs, which are 24 hours in cyberspace.

It is shown that the scale of cyber technologies cause the need to protect users from cyber threats risks of using computers. The negative impact of computer technology manifests itself in all stages of its application. In the workplace of the user there are dangerous and harmful factors. The main object in the work is a process of negative and dangerous impact of cyber hazards on professional safety of workers and employees. The main attention is paid to human security as the main element determining the source of threats and the necessity for its protection.

In accordance with the concept of the National Cyber Security adopted in 2016, these issues should be dealt with everything, but everyone at their level.

As a result of the research, analysis of background information and available technical literature, it is found that currently cyber hazard moved beyond IT specialists and its problems began to deal with the national security level.

Keywords: computerization, cyber security, cyber threat, risk, media ecology, communications, environment, user workstation.

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DEVELOPMENT OF THE INFORMATION TECHNOLOGY FOR CARDIOVASCULAR RISK DETERMINATION IN PATIENTS WITH IMPAIRED RENAL FUNCTION

page 60–66

The information technology for cardiovascular risk determination in patients with impaired renal function is developed. It is the object of research. This information technology reflects the specific progression of cardiovascular complications in patients with nephrology pathology. Context diagrams are built. They describe input, output, control actions, functional information processes, data stores, external entities and data traffic flows between them. The essence of information processes is revealed. They allow to simulate the relationship of cardiovascular risk factors from risk formation values, to determine cardiovascular risk and to protect the confidentiality of stored information. Information-logical data model is built. It reflects all of the objects and events, information on which needs to be stored, and the connections between them. The structure of the information system for cardiovascular risk determination in patients with impaired renal function is proposed. It will to automate and justify the determination of significant factors of cardiovascular risk, the likelihood of cardiovascular complications, and thereby improve the quality of care for patients with impaired renal function.

Keywords: ER-model, information technology, context diagram, cardiovascular risk.

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FORMATION OF ADAPTIVE DYNAMIC SCENARIOS IN COMPUTER EDUCATIONAL SYSTEMS

page 66–71

Considered dynamic scenarios in adaptive educational systems have the following disadvantages:

- Insufficient analysis of learning estimation classifiers.
- Little attention is given to estimation of focus attention on the material.

To address these issues in the study materials we use the works of other scientists that is devoted to adaptive methods of presentation and testing in educational systems.

Process formalization of building a knowledge base is done using semantic networks and an estimation of the minimum and maximum limit of the number of rules is obtained. The minimum number of test questions on the topic to form linear plots is within 3–5 (depending on the topic complexity), the maximum number of questions – 11.

Estimation algorithms within adaptive educational courses for learning control are implemented. Requirements to tests are formed as a part of the estimation algorithms, which include:

- Independent of the tasks.
- Simplicity and compactness of question formulation.
- Exclusion of ambiguous question understanding.

The complex model of the educational process is developed using information technologies. This model includes presentation of technological, targeted, meaningful and effective system components and their relationships (substantiation of learning objectives, content modules of curriculum, conditions for achieving goals, learning activities of students and teachers, learning results). This model allows to use approaches for building of dynamic scenarios, which include the principles of non-linearity of the plot, a variety of solutions, loose problem solutions, variety of ways to pass educational courses.

Keywords: adaptive educational materials, e-learning, educational process, knowledge testing.

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