

## STRESZCZENIA

**Walerij KORESCHKOW**

Komitet Normalizacji Mińsk, Białoruś

**Tatiana ALEKSIEJEWA, Aleksandr LACHOWICZ, Michail CHEJFEC**

Połocki Uniwersytet Techniczny, Nowopołock, Rosja

**ПРОЕКТИРОВАНИЕ ТЕХНОЛОГИЧЕСКИХ ПРОЦЕССОВ НА ОСНОВЕ ИСПОЛЬЗОВАНИЯ SADT - ДИАГРАММ****PROJEKTOWANIE PROCESÓW TECHNOLOGICZNYCH Z WYKORZYSTANIEM DIAGRAMÓW SADT****DESIGNING OF MANUFACTURING PROCESSES ON THE BASIS OF USE SADT - DIAGRAMMES**

It is shown, that the technology of the automated designing of control systems of dynamic objects on the basis of use of SADT-diagrammes consists in accomplishing of sequence of stages: the analysis of a class of commitments subject to the decision, developments of program modules, modelling of dynamic object, calculation of concrete parameters of model, the analysis of results of modelling, decision-making on applicability of the developed system.

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**Witalij PASIECZNIK, Władimir KORENKOW, Julia ŁASZINA**

Politechnika Kijowska, Kijów, Ukraina

**ФОРМАЛИЗАЦИЯ ВЫЯВЛЕНИЯ КИНЕМАТИЧЕСКИХ И СИЛОВЫХ ЦЕПЕЙ В СБОРОЧНЫХ ИЗДЕЛИЯХ****FORMALIZACJA IDENTYFIKACJI KINEMATYCZNYCH I SIŁOWYCH ŁAŃCUCHÓW W WYROBACH MONTAŻOWYCH****FORMALIZATION OF DETECTING THE KINEMATIC AND FORCE CHAINS IN ASSEMBLY PRODUCTS**

This paper presents the possibility of decreasing the product cost by reducing part count. It is shown, that there is the possibility to formalize the kinematic analysis of mechanism. The new algorithm of detecting the kinematic and force chains in assembly product is proposed. The application of algorithm has been demonstrated on an example.

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**Jurij KUZNIECOW, Dmitrij DMITRIJEJEW, Władimir FIRIANSKIJ**

Politechnika Kijowska, Kijów, Ukraina

**МОДУЛЬНЫЙ ПРИНЦИП ПИРАМИДАЛЬНЫХ КОМПОНОВОК СТАНКОВ С ПАРАЛЛЕЛЬНОЙ КИНЕМАТИКОЙ****MODUŁOWA ZASADA KONFIGUROWANIA PIRAMIDALNYCH OBRABIAREK Z RÓWNOLEGLĄ KINEMATYKĄ****MODULE PRINCIPLE OF PYRAMIDAL ARRANGEMENTS OF MACHINE-TOOLS WITH PARALLEL KINEMATICS**

Ways of creation of the highly technological equipment of new generation, in particular machine tools with parallel kinematics in a basis which it is necessary modular principles of construction are shown. New frame configurations of symmetric spatial structures of multipurpose machine tools and mechanisms synthesized of a set standard and unified modules are offered.

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**Michail SEDYCH**

Uniwersytet Technologiczny STANKIN, Moskwa, Rosja

**МОДУЛЬНЫЙ ПРИНЦИП ПОСТРОЕНИЯ СКЛАДСКИХ СИСТЕМ**

**MODUŁOWA ZASADA PROJEKTOWANIA SYSTEMÓW MAGAZYNOWYCH**

**MODULAR PRINCIPLE CONSTRUCTION OF WAREHOUSE SYSTEMS**

In the article consider the questions of designing of warehouse systems of machine-building manufactures. In the article submit structure and principle of work of a warehouse. The questions detailed open of designing of a zone of a storage of a warehouse of the automated manufacture site and account of duration of a cycle automatic of the crane.

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**Walerij KORESCHKOW, Tatiana ALEKSIEJEWA, Aleksandr LACHOWICZ, Wladimir TOCZIŁO**

Połocki Uniwersytet Techniczny, Nowopołock, Białoruś

**УПРАВЛЕНИЕ ОПЕРАЦИЕЙ КОМБИНИРОВАННОЙ ОБРАБОТКИ НА ОСНОВЕ SADT-ДИАГРАММ**

**STEROWANIE OPERACJĄ ZŁOŻONEJ OBRÓBKĄ Z WYKORZYSTANIEM DIAGRAMU SADT**

**MANAGEMENT OF OPERATION OF THE COMBINED HANDLING ON THE BASIS OF SADT-DIAGRAMS**

It is shown, that use of a combination of the statistical and structural analysis provides management of multifactorial technological operations on a complex of parameters, optimises and specifies in factors through which it is necessary to perform managerial process and on parameters which are necessary for supervising in a mode of real time.

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**Irina RATUSZNAJA**

**Witalij PASIECZNIK**

Uniwersytet Techniczny „Politechnika Kijowska”, Kijów, Ukraina

**ТРАНСФОРМАЦИЯ МАТЕМАТИЧЕСКОЙ МОДЕЛИ СБОРОЧНОГО ИЗДЕЛИЯ В МОДЕЛЬ ОГРАНИЧЕННОЙ ПОСЛЕДОВАТЕЛЬНОСТИ ТЕХНОЛОГИЧЕСКИХ ОПЕРАЦИЙ СБОРКИ**

**TRANSFORMACJA MODELU MATEMATYCZNEGO MONTOWANEGO WYROBU W MODEL O OGRANICZONYM SZEREGOWANIU TECHNOLOGICZNYCH OPERACJI MONTAŻU**

**TRANSFORMATION OF MATHEMATICAL MODEL OF ASSEMBLY PRODUCT IN A LIMITED NUMBER OF ASSEMBLY SEQUENCES**

This article describes a whole process of transformation of binary relations between parts of assembly product based on its 3D model into a full scheme of assembly. The method consists in transformation of disassembly scheme into a set of assembly sequences which are further restricted by manufacturing peculiarities. After having several assembly sequences a final decision as for the most optimal assembly sequence is taken by an expert considering manufacturing restrictions and working experience.

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**Siergiej GORSKI**

Uniwersytet Technologiczny STANKIN, Moskwa, Rosja

**МИНИМИЗАЦИЯ МОЩНОСТИ МАТЕРИАЛЬНОГО ПОТОКА ПУТЕМ ПРИМЕНЕНИЯ РАЦИОНАЛЬНОЙ РАССТАНОВКИ ТЕХНОЛОГИЧЕСКИХ МОДУЛЕЙ НА ПРОИЗВОДСТВЕННОМ УЧАСТКЕ**

**MINIMALIZACJA STRUMIENIA MATERIAŁOWEGO PRZEZ RACJONALNE ROZMIESZCZENIE MODUŁÓW TECHNOLOGICZNYCH W GNIAZDACH PRODUKCYJNYCH**

## **MINIMIZATION OF CAPACITY OF THE MATERIAL FLOW BY MEANS OF RATIONAL ARRANGEMENT OF TECHNOLOGICAL MODULES ON THE PRODUCTION SECTION**

There is a description of the question of a decrease in costs for transportation of products in machine-assembling production in this article. This decrease is based on the procedure, which is offered by the author and is founded on optimization of material flows on a production section due to a rational arrangement of the technological modules on it. The developed procedure of construction of schemes of an arrangement of the manufacturing equipment on production sections can be used not only at designing of cell-type systems, but also at their operation due to rearrangement machines under conditions of changing of listed products, providing thus a planning flexibility of production.

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**Krzysztof TUBIELEWICZ, Marek KĘSY**  
Politechnika Częstochowska, Częstochowa, Polska

## **ALGORYTMY GENETYCZNE W INŻYNIERII PRODUKCJI**

### **GENERIC ALGORITHMS IN PRODUCTION ENGINEERING**

An usability of artificial intelligence methods in production management has been presented. An efficiency of generic algorithm's method in production schedule has been compared with selected optimization algorithms and heuristic rules – priority rules.

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**Władimir WORONIENKO**  
Uniwersytet Technologiczny STANKIN, Moskwa, Rosja

## **ТЕХНОЛОГИЧЕСКАЯ ПОДГОТОВКА МЕХАНОСБОРОЧНОГО ПРОИЗВОДСТВА С ИСПОЛЬЗОВАНИЕМ МОДУЛЬНОГО ПОДХОДА**

### **TECHNOLOGICZNE PRZYGOTOWANIE PRODUKCJI MECHANICZNO-MONTAŻOWEJ Z WYKORZYSTANIEM PODEJŚCIA MODUŁOWEGO**

### **DESIGNING AND TECHNOLOGICAL PREPARATION OF MECHANICAL ASSEMBLY PRODUCTION USING MODULAR APPROACH**

The article describes aspects of designing and technological preparation of production using modular approach. Such methodology allows high reduction of time required for generation and reconstruction of manufacturing systems and technological preparation of production, which, as result, will increase the competitiveness of products manufactured.

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**Witalij DOŁGOW**  
Uniwersytet Technologiczny STANKIN, Moskwa, Rosja

## **УПРАВЛЕНИЕ КОНФИГУРАЦИЯМИ ТЕХНОЛОГИЧЕСКИХ СИСТЕМ В ПОЗАКАЗНОМ ПРОИЗВОДСТВЕ**

### **ZARZĄDZANIE KONFIGURACJĄ SYSTEMÓW TECHNOLOGICZNYCH W REALIZACJI ZAMAWIANEJ PRODUKCJI**

### **CONFIGURATION MANAGEMENT OF MANUFACTURING SYSTEM IN ORDER PRODUCTION**

Realization concept of manufacturing system configuration management in order production is offered. This concept provides dramatically increase of the efficiency of the manufacturing system by means of configuration management in areas like technical and organizational requirements.

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**S.G. ZUBKOW, W.J. REZNICZENKO, D.S. CHMIEL**

Akademia Rynku i Technologii Informatycznych MARTIT, Moskwa, Rosja

**СКОРОСТНОЙ ВЕРТОЛЕТ С ОСЕВЫМ ОБТЕКАНИЕМ ВИНТОВ – ВИНТОЛЕТ**

**SZYBKOCIOWY HELIKOPTER Z OSIOWYM OPLYWEM ŚMIGIEŁ**

**THE HIGH-SPEED HELICOPTER WITH AN AXIAL FLOW OF SCREWS – ROTORFLY**

Rotorfly – The concept of an AIRCRAFT flying by air screw in axial stream combining advantages of the helicopter and ortopter.

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**Walerij A. KIRILOWICZ, K.G. BIDENKO, N.W. MAKARENKO**

Instytut Inżynierijno Technologiczny, Żytomierz, Ukraina

**АВТОМАТИЗИРОВАННАЯ КЛАССИФИКАЦИЯ ЗОН ОБСЛУЖИВАНИЯ  
ТЕХНОЛОГИЧЕСКОГО ОБОРУДОВАНИЯ ПРОМЫШЛЕННЫМИ РОБОТАМИ**

**AUTOMATYCZNE KLASYFIKOWANIE STREF OBSŁUGI URZĄDZEŃ  
TECHNOLOGICZNYCH PRZEZ ROBOTY PRZEMYSŁOWE**

**THE AUTOMATED CLASSIFICATION FOR THE TECHNOLOGICAL EQUIPMENT SERVICE  
ZONES BY INDUSTRIAL ROBOTS**

The opportunity of automation of classification of zones of service of technological equipment with the subsequent definition of the size, arrangement and coordinate direction of possible acces setting of the industrial robot in a zone of service is considered Classification of zones of service of technological equipment an industrial robot is for what conducted and the method the automated of classification of zones of service is developed.

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**M.B. BARAKATIN, W.J. REZNICZENKO**

Akademia Rynku i Technologii Informatycznych MARTIT, Moskwa, Rosja

**ОСОБЕННОСТИ СОЗДАНИЯ ШУМОПОГЛОЩАЮЩИХ ПАНЕЛЕЙ  
ИЗ БАЗАЛЬТОПЛАСТИКА**

**CECHY CHARAKTERYSTYCZNE OPRACOWANIA PANELI Z BAZALTOPLASTYKÓW  
POCHŁANIAJĄCYCH HAŁASY**

**MANUFACTURING ANTINOISE PANELS PRODUCED FROM BAZALTPLASTIC**

The development of the construction and manufacturing antinoise panels produced from composite materials with using bazalt filament for the engine of civil aircraft.

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**Nikołaj POPOK**

Połocki Uniwersytet Techniczny, Nowopołock, Białoruś

**МНОГОФУНКЦИОНАЛЬНЫЙ БЛОЧНО-МОДУЛЬНЫЙ РЕЖУЩИЙ ИНСТРУМЕНТ**

**WIELOFUNKCYJNE BLOKOWO-MODUŁOWE NARZĘDZIA SKRAWAJĄCE**

**MULTIPURPOSE BLOCK – MODULE TOOL FOR CUTTING**

Basic trends of ensuring multipurpose equipment are examined, the models of the data base formation are presented, complex treatment and multipurpose tool are described, the results of testing the tool are given.

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**Aleksandr KASTRIUK**

Połocki Uniwersytet Techniczny, Nowopołock, Białoruś

**ПРОЕКТИРОВАНИЕ РАБОЧИХ ОРГАНОВ ПОЧВООБРАБАТЫВАЮЩИХ МАШИН**

**PROJEKTOWANIE ORGANÓW ROBOCZYCH ZIEMNYCH MASZYN ROLNICZYCH**

**DESIGNING OF WORKING BODIES OF SOIL-CULTIVATING MACHINES**

For the offered type of knives the zone of change of a corner of cutting without essential growth of traction resistance that is considered important at regulation of a corner of an inclination of an occipital platform for maintenance of necessary density of ground.

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**Władimir A. TIMIRIAZEW, Aleksiej A. SEREBRIAKOW**

Uniwersytet Technologiczny STANKIN, Moskwa, Rosja

**ИСПОЛЬЗОВАНИЕ МОДУЛЕЙ КОНСТРУКТИВНО-ТЕХНОЛОГИЧЕСКИХ ПРОТОТИПОВ  
ДЛЯ ПРОЕКТИРОВАНИЯ ТЕХНОЛОГИЧЕСКИХ ПРОЦЕССОВ В ДИАЛОГЕ ЭВМ**

**WYKORZYSTANIE MODUŁÓW KONSTRUKCYJNO-TECHNOLOGICZNYCH PROTOTYPÓW DO  
PROJEKTOWANIA PROCESÓW TECHNOLOGICZNYCH W SYSTEMIE DIALOGOWYM**

W artykule przedstawiono zagadnienia automatycznego projektowania procesów technologicznych ze wspomaganie komputerowym z wykorzystaniem podejścia modułowego do typizacji części maszyn i technologii.

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**Michał DUPLAGA, Dorota STADNICKA**

Politechnika Rzeszowska, Rzeszów, Poland

**WDRAŻANIE TPM W PRAKTYCE DUŻEGO PRZEDSIĘBIORSTWA**

**TPM IMPLEMENTATION IN A LARGE ENTERPRISE**

In the work the conception of TPM (Total Productive Maintenance), its advantages and basics are presented. Stages of TPM implementation are described too. The results of equipment functioning analysis made for a chosen department in a large enterprise is shown. The article indicates the actions, which should be done to develop production equipment management process.

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**Roman KIELEC**

Uniwersytet Zielonogórski, Zielona Góra, Polska

**PLANOWANIE PROCESÓW PRODUKCYJNYCH O CHARAKTERZE ITERACYJNYM**

**PLANNING OF ITERATIVE PRODUCTION PROCESSES**

There are traditional production planning methods shown in this paper. Particular focus was put on insufficiency of basic planning method such as Gantt, PERT, etc. A new method based on matrix process representation is proposed. Its main advantage is to allow for iterative processes characteristic for complex production cycle.

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**Józef BEDNARCZYK, Wojciech WALOTEK**

Akademia Górniczo-Hutnicza, Kraków, Polska

**ZAUTOMATYZOWANE GNIAZDO DO ELEKTRODYNAMICZNEGO MONTAŻU ELEMENTÓW  
SYSTEMU RYNNOWEGO**

**AUTOMATED SOCKET FOR ELECTRODYNAMIC ASSEMBLY OF GUTTER SYSTEM  
ELEMENTS**

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The article demonstrates an unconventional method developed at AGH – University of Science and Technology, involving electrodynamic mounting of a pipe to cover of an inspection tank constituting gutter system component. Moreover, the article presents an automated socket with pneumatic drives for industrial component production using electrodynamic technology.

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**Bogusław REIFUR**

Politechnika Wrocławska, Wrocław, Polska

**Bartłomiej ENGEL**

Donako S.A., Wrocław, Polska

#### **MODUŁ WSPOMAGANIA PRAC PROJEKTOWYCH DLA KONFIGURACJI ERGONOMICZNYCH STANOWISK MONTAŻOWYCH**

#### **MODULE FOR ERGONOMIC ASSEMBLY STANDS CONFIGURATION USING IN DESIGNING**

Assembly stand designing, using the program modules, which allow stands evaluation in relation to ergonomic requirements in today's industry operating conditions, give the possibility of efficiency and economical benefits increasing. Especially in the assembly conditions requiring repeating activities where the considerable physical and psychological burden exists. The article presents the program module, which was worked out by ITMiA i Wrocław Technical University. The module lets consider every conditions related to stand area for manual assembly in the stage of project creation.

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**Michail CHEJFEC, Elena ZEWELEWA**

Połocki Uniwersytet, Nowopołock, Białoruś

**Leonid AKUŁOWICZ**

Agrarny Uniwersytet Techniczny, Mińsk, Białoruś

#### **МЕХАТРОННЫЕ ТЕХНОЛОГИЧЕСКИЕ КОМПЛЕКСЫ ДЛЯ ОБРАБОТКИ И УПРОЧНЕНИЯ ИЗДЕЛИЙ**

#### **MECHATRONICZNE KOMPLEKSY TECHNOLOGICZNE DLA OBRÓBK I UMACNIANIA WYROBÓW**

#### **MECHATRONIC TECHNOLOGICAL COMPLEXES FOR PROCESSING AND HARDENING OF PRODUCTS**

The methodology of optimising synthesis of technological complexes of highly effective processing of products is offered. Application of flexible industrial complexes for increase of productivity thanks to highly effective methods of processing is recommended; manufacture automation, both with technological, and with a subject principle of the organisation; to manufacture construction on principles of self-organising of technological processes.

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**Leonid AKUŁOWICZ**

Agrarny Uniwersytet Techniczny, Mińsk, Białoruś

**Aleksandr SADIUKOWICZ**

Zakład „POLIMIR”, Nowopołock, Białoruś

**Elena ZEWELEWA, Michail CHEJFEC**

Połocki Uniwersytet, Nowopołock, Białoruś

#### **УПРАВЛЕНИЕ В МЕХАТРОННЫХ ТЕХНОЛОГИЧЕСКИХ КОМПЛЕКСАХ КОМБИНИРОВАННОЙ ОБРАБОТКИ В ЭЛЕКТРОМАГНИТНОМ ПОЛЕ**

#### **STEROWANIE W MECHATRONICZNYCH ELEKTRONICZNYCH KOMPLEKSACH ZŁOŻONĄ OBRÓBKĘ W POLU ELEKTROMAGNETYCZNYM**

#### **MANAGEMENT IN MECHATRONIC TECHNOLOGICAL COMPLEXES THE COMBINED PROCESSING IN THE ELECTROMAGNETIC FIELD**

Features of use of technological complexes of the combined processing at the machine-building enterprises are considered. It is shown, those in the technological complexes combining processes of hardening and restoration with machining of details of cars, feedback of technological system provide self-organising of processes of formation of a surface and allow to operate their stability.

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**Andrzej ZBROWSKI**

Instytut Technologii Eksploatacji – PIB, Radom, Polska

## **MODUŁOWA STRUKTURA MINIATUROWEGO TRIPODA LABORATORYJNEGO**

### **MODULAR STRUCTURE OF MINIATURE LABORATORY TRIPOD**

The article presents structure of precise parallel tri-axle manipulator with functionality of moving-inclining table. End effector of the device is a platform, for which three coordinates of position are defined. The concept of the positioning mechanism is based on parallel tripod kinematics where end effector – the platform – is seated on three active limbs – actuators. The use of parallel kinematics allowed modular construction of positioning mechanism. The developed modular functional mechanism with minimal number of elements in kinematic chain ensures high positioning resolution. The concept of application of eccentric mechanism for platform positioning is an original idea in this solution.

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**Aleksander STREUBEL, Marek KURAN**

Politechnika Wrocławska, Wrocław, Polska

**Marek UCHMAN**

Jurgal, Mikołów, Polska

## **PROCEDURA REGENERACJI GŁOWIC SILNIKA SPALINOWEGO**

### **PROCEDURE FOR COMBUSTION ENGINE HEAD REGENERATION**

In the article a procedure of combustion engine head repair is presented. The procedure was worked out in JURGAL-Mikołów plant. Range of activities, which depends on size of a head wear was described too. Necessary equipment, tools and machining parameters fulfill the requirements for new head are also discussed.

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**Andrzej ZBROWSKI, Jordan MEŻYK, Piotr CZAJKA**

Instytut Technologii Eksploatacji – PIB, Radom, Polska

## **MODUŁOWY MANIPULATOR DO POMIARÓW AKUSTYCZNYCH W KOMORZE BEZECHOWEJ**

### **MODULAR MANIPULATOR FOR ACOUSTICAL MEASUREMENTS IN ANECHOIC CHAMBER**

The article presents modular structure of special manipulator for acoustical research in anechoic chamber. Presented modular solution allows automatic measurement with minimal interference in acoustical field. Manipulator allows automatic positioning of measurement microphone on the hemisphere. The manipulator consists of three modules: rotating platform module with vertical axis to manipulate the object under test, planar XY scanning module to manipulate measurement device and support and suspension module for the XY scanning module. Composition of platform rotation and planar movement of XY scanning modules creates measurement space in the shape of hemisphere. Geometrical dimensions of modules allow research in measurement hemisphere of maximum radius of 2000 mm.

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**Rafał KLUZ**

Politechnika Rzeszowska, Rzeszów, Polska

## **WYZNACZENIE OPTYMALNEJ ORIENTACJI CHWYTAKA ROBOTA MONTAŻOWEGO**

### **THE DEFINITION THE OPTIMUM ORIENTATION THE GRIPPER OF ROBOT**

It the results of measurements in article were introduced was and the statistical investigations of mistake of repeatability the gripper of robot. It the mathematical model was proposed was the giving the possibility of definition of optimum orientation gripper also, assuring the the best parameters of process of breeding of part the as well as maximum probability of assembly of cylindrical parts

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**Tadeusz KOWALSKI, Marian NIEDBAŁA**

Politechnika Warszawska, Warszawa, Polska

**CBKO sp. Z o.o.**, Pruszkow, Polska

#### **MODUŁ AUTOMATYZUJĄCY PODAWANIE I MAGAZYNOWANIE PRZEDMIOTÓW OBRABIANYCH NA CENTRUM TOKARSKIM**

#### **A MODULE FOR AUTOMATION OF HANDLING AND STORING OF WORKPIECES ON A CNC LATHE**

Feasibility study of a CNC lathe expansion by adding a module for automation of auxiliary operations. Design of a gantry loader and a rotary storage unit for workpieces. Required modifications for the CNC lathe in order to install the loader and storage unit. Guidelines for CNC machine tool design regarding auxiliary equipment expansion.

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**Jerzy HONCZARENKO, Artur BERLIŃSKI**

Zachodniopomorski Uniwersytet Technologiczny, Szczecin, Polska

#### **MODUŁOWA BUDOWA ZAUTOMATYZOWANYCH STANOWISK TECHNOLOGICZNYCH OBRÓBKI PLASTYCZNEJ NA PRASACH**

#### **THE MODULE BUILDING OF AUTOMATED WORK PLACE BASED ON PLASTIC PROCESSING ON PRESSES**

The paper presents direction of the development and automation area in work places based on plastic processing. Shows types of module components to building such work places. Example of module building – conception project automated work places to manufacturing auto-parts was presents. Project presumptions and principal parts were present such as: material flow subsystem, and automated tool change on presses.

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**Paweł PRZYBYLEK, Andrzej KOMOREK**

Wyższa Szkoła Oficerska Sił Powietrznych, Dęblin, Polska

#### **MODUŁOWA BUDOWA SILNIKÓW LOTNICZYCH WOJSKOWYCH STATKÓW POWIETRZNYCH**

#### **MILITARY AIRCRAFT ENGINES' MODULARIZATION**

Modern turbojet engines are modular in concept and design. The paper presents an application of modularity in military aircraft engine. The central power-producing core, common to all jet engines, is called the gas generator. To it are attached peripheral modules such as propeller reduction gear sets (turboprop/turbo shaft), bypass fans, and afterburners. The kind of peripheral fitted is dependend on the aircraft design application. An example will be F100-PW-229 military engine and the PT6A engine family remains the world's most popular engine in its class and is one of P&WC's greatest success stories.

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**Iwan OBORSKI**

Uniwersytet Technologii i Projektowania, Kijów, Ukraina

**TECHNOLOGICZNE PODSTAWY MONTAŻU POŁĄCZEŃ WCISKANYCH TERMICZNIE Z WYKORZYSTANIEM REGULARNEGO MIKRORELIEFA W STREFIE KONTAKTU**

**ТЕХНОЛОГИЧЕСКИЕ ОСНОВЫ СБОРКИ СОЕДИНЕНИЙ С НАТЯГОМ ТЕРМИЧЕСКИМИ СПОСОБАМИ С ИСПОЛЬЗОВАНИЕМ РЕГУЛЯРНОГО МИКРОРЕЛЬЕФА В ЗОНЕ КОНТАКТА**

**THE TECHNOLOGICAL JOINT ASSEMBLY FOUNDATIONS WITH TIGHTNESS BY THE THERMAL METHODS USING THE MICRORELIEF IN THE CONTACT ZONE**

The ways of the technological maintenance of the high-quality joint assembly with tightness by the thermal methods are suggested, and the analytical dependences for defining of the separate efficient process variables to ensure the decrease of energy and time (temporary) during the combined thermal method of assembly are also given.

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**Iwan OBORSKI**

**Anatolij ZENKIN**

Uniwersytet Technologii i Projektowania, Kijów, Ukraina

**ZASTOSOWANIE SPECJALNEJ TOPOLOGII MIKRORELIEFU PRZY TERMICZNYM MONTAŻU POŁĄCZEŃ WCISKOWYCH**

**ПРИМЕНЕНИЕ СПЕЦИАЛЬНОЙ ТОПОЛОГИИ МИКРОРЕЛЬЕФА ПРИ СБОРКЕ СОЕДИНЕНИЙ С НАТЯГОМ ТЕРМИЧЕСКИМИ СПОСОБАМИ**

**THE USE (APPLICATION) OF THE SPECIAL MICRORELIEF TOPOLOGY DURING THE JOINT ASSEMBLY WITH TIGHTNESS BY THE THERMAL METHOD**

The ways of the increasing durability and decreasing deflected mode of the joints with tightness during the thermal method of their assembly at the expense of the development and use of the special microrelief topology on the joint face of the male part are suggested. The data of the experimental researches corroborating the theoretical results are given.

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**Witalij SZALAŁAJ, Iwan OBORSKI, Anatolij ZENKIN**

Uniwersytet Technologii i Projektowania, Kijów, Ukraina

**ZASTOSOWANIE WARSTW KLEJOWYCH W MONTAŻU POŁĄCZEŃ WCISKANYCH METODĄ NAGRZEWANIA**

**ПРИМЕНЕНИЕ ПРОМЕЖУТОЧНЫХ ПРОСЛОЕК В ЗОНЕ КОНТАКТА ПРИ СБОРКЕ СОЕДИНЕНИЙ С НАТЯГОМ ТЕРМИЧЕСКИМИ СПОСОБАМИ**

**THE USE (APPLICATION) OF THE MEDIUM (INTERMEDIATE) LAYERS IN THE CONTACT ZONE DURING THE JOINT ASSEMBLY WITH TIGHTNESS BY THE THERMAL METHODS**

The ways of the increasing durability of the joints with tightness and glue composition and calculation dependences that permit to take into account the presence of the medium layers in the contact zone of the seams forming by the thermal methods on the design phase are suggested.

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**Jerzy STÓS, Andrzej KASPRZAK, Janusz HYŻY, Marcin KOWALIK**  
Instytut Zaawansowanych Technologii Wytwarzania, Kraków, Polska

## **MODUŁ KOMPENSACYJNY PODATNY W ZESPOŁACH WCISKAJĄCYCH**

### **COMPENSATORY FLEXIBLE MODULUS IN PRESSING UNITS**

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Frequency controlled AC electric drivers with mechanical gears (angular or ball screws) are often used in assembling installations in which the process of joining items or units takes place by pressing. In the assembling technology by pressing the efficiency (it means the potentials to perform the pressing at great speed) is as significant as the joining quality (accuracy and load capacity). The high accuracy of the joint is to be obtained by means of hard end stop pressing but because of this process the electric driver are subjected to great loads due to the sudden increase of unfavourable pressing forces. Therefore the use of force protective, compensatory flexible unit has been implicated, which would secure the driver while the hard end stop pressing is carried out. The paper presents the design of such modulus and results of investigations and tests an force hard end stop rise at the speed of 30 mm/s controlled by PLC.

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**Marek ROŚKOWICZ**

Wojskowa Akademia Techniczna, Warszawa, Polska

## **TRWAŁOŚĆ ZMĘCZENIOWA POŁĄCZEŃ NITOWYCH**

### **THE FATIGUE LIFE OF RIVETED JOINTS**

The strength and fatigue life of riveted, hybrid (riveted-adhesive) and riveted joints reinforced composite patch have been investigated. Fatigue life riveted joints reinforced composite's patch, where using different epoxy materials – Epidian 53/Z1 and Epidian 57/Z1 was estimated. The results of experimental investigation of failure riveted joints and repair riveted joints were compared. The best results were received for joints where it was used lower elastic modulus adhesive (to forming composite patch). In the experimental investigation were obtained fatigue life of repair joints equal non-failure joints. The proposed in the work method of repairing of damaged riveted joints seems effective and it can make the alternative for repairs consisting in using metallic patch.

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**Stanisław GIL**

Politechnika Krakowska, Kraków, Polska

## **BADANIA DYNAMICZNE WYBRANYCH POŁĄCZEŃ ELEMENTÓW UCHWYTÓW SKŁADANYCH**

### **THE DYNAMIC ANALYSIS OF SELECTED CONNECTIONS OF MODULAR FIXTURE ELEMENTS**

The dynamic analysis of connections of modular fixture elements were carried out. The amplitude and frequency characteristics were determined. The influence of different combinations of columns and plates on the displacement were investigated.

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**Wiktorija MNACAKANIAN, Porfirij BOJKO**

Uniwersytet Górniczy, Moskwa, Rosja

## **REGENERACJA POWIERZCHNI ROBOCZYCH MIMOŚRODOWYCH TULEI W MECHANIZMACH KRUSZAREK**

### **ВОССТАНОВЛЕНИЕ РАБОЧИХ ПОВЕРХНОСТЕЙ ЭКСЦЕНТРИКОВЫХ СТАКАНОВ ДРОБИЛЬНЫХ АГРЕГАТОВ**

W artykule przedstawiono technologie regeneracji mimośrodowych tulei i kulistych opor kruszarko – rozdrabniarek z pomocą nakładanych powłok metodą płomieniowo – gazową.