Annotations of materials for participation in a competition
for the academic position " Associate rofessor"
of Assistant Professor, PhD, MEgn Emil Georgiev Velev

Г 7.1. Ionut Geonea, Cristian Copilusi, Laurentiu Racila, Daniela Shehova, Slavi Lyubomirov, Emil Velev. (2023), Dynamic Study and Structural Optimization of the Connecting Rod from a Thermal Combustion Engine. Physics AUC, vol. 33, pp. 9-20 (2023). https://www.scopus.com/record/display.uri?eid=2-s2.0-85180483476&origin=resultslist …..Scopus

In this paper, we present a study on the structural optimization of a rod in a 1-cylinder in-line thermal engine. To perform this optimization, we use the finite element analysis program, ANSYS. We parametrically model the connecting rod using ANSYS Design Modeler. We consider some geometrical dimensions, such as bond radii and relief channels, as structural optimization parameters. The objective function of this optimization is to reduce the stress concentrators, in order to increase the fatigue strength, but also to reduce the mass of the connecting rod. We present the obtained results in the form of 3D graphics. We will present the optimal solution for the geometric shape of the reel. The study demonstrates the effectiveness of structural optimization programs in achieving the optimal effect of part design shapes.

Г 7.2. Racila Laurentiu, Ionut Geonea, Cristian Copilusi, Daniela Shehova, Slavi Lyubomirov, Emil Velev. (2023). Study on Assisting People with Logomotor Disabilities to Climb Stairs with the Help of an Exoskeleton. Physics AUC, vol. 33, pp. 1-8 (2023). https://www.scopus.com/record/display.uri?eid=2-s2.0-85180457950&origin=resultslist ….Scopus

In this article, we aim to address the topic of assisting a person with mobility impairments in climbing stairs. This assistance will be achieved using a robotic system such as an exoskeleton. The designed exoskeleton must provide the step length corresponding to the distance between two steps, as well as the leg lift height sufficient to step on the next stair. For this purpose, a solution for designing a robotic exoskeleton system is proposed. Based on this design solution, a virtual prototype of the robotic system will be realized, followed by a dynamic simulation using software for dynamic analysis of multi-body systems, namely ADAMS. The results of the simulation allow us to validate the design decision, on this conclusion we will proceed to the next stage of the research, namely the implementation of an experimental prototype.

Г.8.3. V. Rupetsov, Iv.Uzunov, A. Mishev, Iv. Panov, **E. Velev**.Study of wear intensity of solid nanocoatings deposited on steel 1.2080 (X12).Bulgarian Chemical Communications, Volume 53, Issue 4 (pp. 424 - 428) 2021

https://www.scopus.com/record/display.uri?eid=2-s2.0-85122078403&origin=resultslist&sort=plfdt-f&listId=64780474&listTypeValue=Docs&src=s&imp=t&sid=fdc6560ba2d16efca6f13f55b824f2a8&sot=sl&sdt=sl&sl=0&relpos=0&citeCnt=0&searchTerm= **Scopus**

The wear resistance of hard nanocoatings - TiN, TiCN and nc-TiAlN/a-Si3N4 - deposited on tool steel 1.2080 (X12) was studied. One-factor experimental tests on specific wear intensity resulting from the load were performed. The research methodology is based on the volume of the removed material. Correlation dependences of the specific wear intensity on the load were found. A

comparative assessment of the individual coatings was made and practical guidelines for their application were proposed.

Г 8.1. Aleksiev S., Nachev N, **Velev E.**, Deciphering an existing design gerotor hydraulic gear pair, Tehnomus - New Technologies and Products in Machine Manufacturing Technologies, 2013,ISNN-1224-029X, pp. 430-433

In this paper is presented a methodology for deciphering the gear pair of an existing gerotor hydraulic machine to improve hydraulic and technological parameters or repair work.

Г 8.2. Aleksiev S., Nachev N, **Velev E.**,„Методика за конструиране геролкова хидромашина като определящи са размерите на ролките , XXII МНТК „АДП-2013”, pp. 127-130

This paper describes a methodology for solving the problem of designing the gear pair of a roller-less separator hydromachine, related to the difficult matching of the number of rollers and the standard dimensions of their diameter.

Г 8.3. Aleksiev S., **Velev E** ,Nachev N, ,Подобряване на технически параметри на хидромотор, чрез промяна на профила на героторната двойка, XXII МНТК „АДП-2013”, pp. 117-121

In this paper, the theoretical model by which the torque of the hydromotor will be improved is considered. A method has been proposed by which, without changing the dimensions of the hydromotor, its power can be increased.

Г 8.4. Velev, E. (2023). “Analysis of the Possibilities for Reducing Environmental Pollution through the Use of Bioplastics”, Science Series “Innovative STEM Education”, volume 05, ISSN: 2683-1333, pp. 163-174, 2023. DOI: https://doi.org/10.55630/STEM.2023.0519

Bioplastics are alternative raw materials for the production of plastic products without polluting the environment and a source of material that will be available after we abandon the production of petroleul. They can be produced from renewable sources such as such as vegetable fats and oils, corn starch, straw, woodchips, sawdust, recycled food waste, etc. These products are increasingly relevant after the European Union adopted Directive (EC) 2019/904 on reducing the environmental impact of certain plastic products.

Г 8.5. Емил Велев (2023), Modern technologies in the production of disposable packaging
„Дни на науката 2023” на СУБ – Пловдив 23-24 ноември 2023 г. Научни трудове на Съюза на учените в България–Пловдив, серия Б. Естествени и хуманитарни науки, т. XXI, ISSN 1311-9419 (Print), ISSN 2534- 9384 (On-line), 2023. Scientific researches of the Union of Scientists in Bulgaria-Plovdiv, series B. Natural Sciences and the Humanities, Vol. XXI, ISSN 1311-9419 (Print), ISSN 2534-9384 (On-line), 2024. с.28-317

Disposable packaging has entered both households and industry. Plastic packaging is one of the major polluters of the environment. With the advent of biodegradable plastics, they are one of the possible options for reducing this pollution. By switching to packaging made from different wood that is sustainably produced, we will be able to protect the environment from pollution and preserve it for generations to come.

Г 8.6. Velev E (2023), 3D PRINTERS FOR METAL: CAPABILITIES AND APPLICATION, 2023. Scientific researches of the Union of Scientists in Bulgaria-Plovdiv, series B. Natural Sciences and the Humanities, Vol. XXI, ISSN 1311-9419 (Print), ISSN 2534-9384 (On-line), 2024. p.23-27

With the invention of 3D printers for metal, the technologies for the production of details for both industry and home have changed radically. It is now possible to produce details for which this was not possible until now. Like any new technology, this one is relatively expensive and slow at the moment, but as it enters the industry widely, this will change.

Г 8.7. Velev E. (2023),Research of injection molding processes of different types of material using computer simulation Journal of Physics and Technology, Vol. 5, Issue 1, pp. xxx-xxx (2024) (под печат).

In recent decades, polymers have widely entered all spheres of life. A prerequisite for this is the ability to produce details of different types, complexity and color. This is done in injection molds, which can be single-well or multi-well depending on the production program. With the constant appearance of new plastics and modifications of existing ones, new and new challenges appear before the designers of injection molds, namely, even before a given tooling is produced, what is the possibility of producing parts from different types of plastic with the same plastic injection mold. This problem without the use of computer technology is practically impossible.

Г 8.8. Velev E. (2024), Tooth comb profiling and fabricated on a wire erosion machine, „Mechanical Engineering and Science“, Volume 34, 2023, ISSN 1312-8612, pp.51÷54

In the present paper, the profiling of a tooth comb is considered. A method for making the cutting part of the tool on a wire erosion machine is presented. When grouting profile tools in a straight line on the wire erosion machine, the exact profile is produced. The method is applicable to the final production of tools from hardened and hard alloyed materials.

Г 8.9. Velev E., Modifications of geroton hydraulic motors at a constant inside diameter of the stator „Mechanics of Machines”, Volume 129, 2023, ISSN 0861-9727, p. 43-46

Gerotor hydraulic motors are widely used in industry, where it is necessary to realize high power and smooth operation in a small space. Therefore, it is necessary to develop possible variants of gerotor tooth pairs that can be realized in a given stator gauge. In this way, hydromotors with different technical parameters can be realized.

Г.8.10. Velev E. (2022), TYPES OF PLA PLASTICS AND THEIR APPLICATION, Collection of papers from a National scientific conference with international participation on the topic "Education, Science, Society", ISBN 978-619-7663-43-3 (online) 2022, p.984-991

The details made of engineering plastics are characterized by very good physical and mechanical properties. That is why they have found a very large application in industry. Unfortunately, they are manufactured petroleum products, which has an increasing impact on the environment. One of the possibilities to limit their use is the use of plastics obtained from renewable sources. PLA plastics are a very good alternative because they are derived from plant resources.

Г 8.11. Емил Велев (2021), Стенд за изследване на коефициента на триене между биополимерна полимлечна киселина (PLA) и покритията на титанова основа, Съюз на учените в България – Смолян, Научни трудове , Том III, част 3, Смолян 2022,ISSN: 1314-9490 (online), с. 431÷439

Plastic products are widely used in our lives and industry. With Directive (EC) 2019/904 - on reducing the environmental impact of certain plastic products, the European Union aims to prevent and reduce the environmental impact of certain plastic products and to promote the transition to a circular economy through the introduction of a combination of measures tailored to the products covered by the directive, including an EU-wide ban on single-use plastic products where alternatives are available. With the use of plastics based on polylactic acid (PLA), which is produced from dextrose (sugar) extracted from bio-based materials, the use of single-use plastic products can be continued. Removing the tooling for the use of PLA plastic in many cases is expensive and in some it is impossible. By using vacuum nano coatings based on titanium and PVD methods for their production make it possible to solve these problems. Therefore, it is important to study the coefficient of friction between PLA and titanium-based coatings.

Г8.12. Емил Велев (2018), Изследване размера на диаметъра на втока при шприцване на чрез използване на топла дюза, SEVENTH INTERNATIONAL SCIENTIFIC CONFERENCE “ENGINEERING, TECHNOLOGIES AND SYSTEMS”, TECHSYS 2018, 17-19 May, Plovdiv, ISSN 2535-0048 (Online), pp.II-223÷226.

In designing tooling using the hot runner molding method, it is important to investigate the diameter of the gate through which the material will pass. This is possible through the use of modern software solutions, which reduce the designing and manufacturing time of molding equipment

Г 8.13. Velev, E. Study cavitation gerotor motors, using computer simulation, XV International Scirntific Conference, 2016, Volume 1, Smolyan, Bulgaria, pp. 64÷66, ISSN-978-619-7180-7

When designing new types of gerotor motor is important to investigate cavitation processes. The study of these processes can give important information about the processes that occur in the hydraulic motor, and may increase its resource.

Г 8.14. Velev E., Lyubomirov Sl., (2023), Methodology for restoring the gerotor pump of automotive hydraulic amplifiers, Mechanics of Machines, book 3, 2023, ISSN 0861-9727 in print.

In the present work, a practical approach for restoring a gerotor pump used in the hydraulic amplifiers of a car is developed and illustrated. The introduction of hydraulic steering is a new era in the automotive industry, because the turning of the steering wheel and, respectively, of the turning wheels is supplemented by a pump, which reduces the required effort. The methodology shown can be used to restore the operability of this vehicle unit.

Г 8.15. Stanislav Asenov, Anatoly Parushev, Slavi Lyubomirov, Daniela Shehova, Hristo Kanevski, Emil Velev. "Creating a three-dimensional virtual hall for engineering education". Journal of Physics and Technology, Volume 1 (2019) Number 1, pp. xx ISSN 2535-0536 (in press).

In the context of rapidly developing technological trends, virtual reality (VR) represents a highly impactful tool for innovation in various sectors, including education. The authors of the article share their experience of creating a virtual classroom with a specialized interactive assembly model with the application of modern technologies in engineering education. Using an integrated approach combining the competencies of tools such as Blender, SolidWorks and Unity, an innovative educational solution has been created that provides deeper learning. The virtual classroom will allow students to be part of an intelligently constructed educational space in which they will be able to not only visualize and manipulate objects, but also assemble them in the virtual space. The essential advantage of this approach is the active involvement of students in the learning process. The virtual environment stimulates interest and imagination by providing the opportunity for real interactions and experiences. The relevance of the article stems from the growing need for innovative educational approaches reflecting modern technological changes and requirements.

Г8.16. A. Parushev, R. Popov, S. Lyubomirov, D. Shehova, St. Asenov, H. Kanevski, **Emil Velev**, S. Shotarova. "Using 3D Modeling to Demonstrate the Device and Operating Principles of an Automotive Clutch". Journal of Physics and Technology, Volume 1 (2019) Number 1, pp. xx ISSN 2535-0536 (in press).

In the report, the authors emphasize modern production technologies, also known as 3D printing or additive manufacturing, which have applications in various areas of human activity. 20 These methods are characterized by accuracy and economy compared to traditional methods of manufacturing parts, components and elements. These technologies are characterized by: low production costs, the ability to create complex and innovative models, flexibility of the materials used and extremely fast production speed. Technological advances in this field are opening doors for the use of additive technologies in the academic and scientific sectors. In this regard, the emphasis of the publication is placed on the creation of a three-dimensional model for students' understanding of the main functional capabilities of the dry, frictional, single-disc clutch in modern cars. This model can be used to create educational and scientific tools that facilitate learning and expand the scope of scientific research in this area, contributing to the improvement of the quality of scientific and educational activity.

Г 8.17. S. Lyubomirov, V. Rupetsov, **E. Velev**. "Methodology for automated fixture design in CAD environments". "Days of Science 2023" of SUB - Plovdiv November 23-24, 2023. Scientific works of the Union of Scientists in Bulgaria - Plovdiv, series B. Natural and humanities, vol. XXIV, ISSN 1311-9192 (Print), ISSN 2534 -9376 (On-line), 2023. Scientific researches of the Union of Scientists in Bulgaria-Plovdiv, series B. Natural Sciences and the Humanities, Vol. XXIV, ISSN 1311-9192 (Print), ISSN 2534-9376 (Online), 2023. (in press).

The report presents a methodology for the automated design of devices in the conditions of CAD environments, used in the training of students of mechanical engineering majors. For the creation of prototypes of the models, a 3D printer Creat Bot PEEK - 300, owned by the Faculty of Physics and Technology at the University of Plovdiv, was used. The Mastercam program (Groover, 2013) was used to develop a machining control program. Emphasis is placed on the design features of the product.

Γ 8.18. S. Lyubomirov, **E. Velev**, St. Assenov, D. Shekhova, Hr. Kanevski, Sn. Shotarova. "Software platforms for three-dimensional automated design" "Days of Science 2023" of SUB - Plovdiv November 23-24, 2023. Scientific works of the Union of Scientists in Bulgaria - Plovdiv, series B. Natural Sciences and Humanities, vol. XXIV, ISSN 1311 - 9192 (Print), ISSN 2534-9376 (On-line), 2023. Scientific researches of the Union of Scientists in Bulgaria-Plovdiv, series B. Natural Sciences and the Humanities, Vol. XXIV, ISSN 1311-9192 (Print), ISSN 2534-9376 (On-line), 2023. (in press).

The report presents the modern CAD systems that are used for fully automated design, technological preparation, analysis and production of products in mechanical engineering and for electronic management of technical documentation. CAD/CAM systems are a suitable environment for automated structural and technological design during detail processing. The report presents modern software platforms for three-dimensional automated design used in the training of students of mechanical engineering specialties. The requirements for technical professions related to industrial production are already changing, and the tasks of specialists who will work in "smart" factories or conduct scientific research, rethink. Therefore, universities are faced with a responsible task, to provide future engineers, technologists, designers with sufficiently deep knowledge and practical skills in the field of the latest technologies, so that they enter the digital world fully prepared.

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