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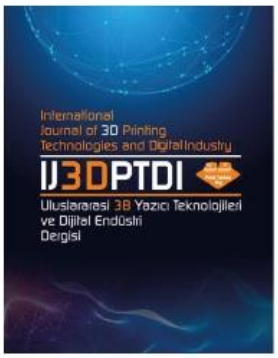

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ABSTRACT PROCEEDINGS

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Program

22 November 2022	Medical Applications for 3D printing, Digital Industry, Program - Control Technologies, Mechanical Properties of Filaments	
	For login please join on your computer, mobile app or room device Click here to join the meeting Meeting ID: 310 501 449 535; Passcode: 9vqF3P	
Time	**Title**	**Presenter**
08:30 – 09:00	**Opening ceremony**	
Chaired by: ***Prof Mustafa Aydın and Dr Hanane Zermane***		
09:00 – 09:30	Improvement of fatigue strength of 3d printed ti6al4v by mechanical surface treatments for medical implants	Hitoshi Soyama
09:30 – 10:00	Bio-Manufacturing Human Tissues In Vitro: From Formulation To Applications	Naresh Kasoju
10:00 – 10:30	Digital twins in manufacturing	Javaid Butt
10:30 - 11:00	Photopolymerization-based Additive Manufacturing of Active Medical Devices	Roger Narayan
11:00 – 11:30	**Coffee break**	
11:30 - 12:00	Materials and Technologies for 3D/4D Printing in Tissue Engineering	Min Wang
12:00 - 12:30	An overview of Blockchain and IOTA Tangle in the Internet of Things	Burhan Duman
12:30 – 12:45	Estimating safety numbers of slopes with artificial neural networks	Betül Şen
12:45 – 13:00	The role of crystallographic texture on grain boundary characteristic distribution for defect prevention in metal additive manufacturing	Ozkan Gokcekaya
13:00 – 14:00	**Lunch**	
Chaired by: ***Prof Ömer Eyercioğlu and Dr Taner ERSÖZ***		
14:00 – 14:15	3D Printers in Neural Tissue Engineering	Sertap Kamçı
14:15 – 14:30	Dox-loaded PLA tumor dressing design with 3D printer for controlled release systems	Ayşe Betül Bingöl
14:30 – 14:45	Wear Performance of Additively Manufactured and Hot Isostatic Pressed Cr	Asli Gunay Bulutsuz
14:45 – 15:00	3D Printing for Tissue Engineering Applications	Neslihan Top
15:00 – 15:15	Digitalization in interior architecture and production of architectural land models with 3D printers	Deniz Altunkaynak
15:15 - 15:30	Machine learning and data mining in human resource management: an application in the automotive industry	Filiz Ersöz

15:30 - 15:45	Nature-Inspired Design Idea Generation with Generative Adversarial Networks	Nurullah Yüksel
15:45 - 16:00	3D Printing Applications in Breast Cancer	Selin Adıgüzel
16:00 – 16:30	**Coffee break**	
Chaired by: ***Prof. Filiz Ersöz and Dr Hakan Maden***		
16:30 - 16:45	Oxide Layers Deposited by Inkjet Printing	Marin Gheorghe
16:45 - 17:00	2D Lattice Generation by Computational Design Method	Nurullah Yüksel
17:00 - 17:15	Autonomous Line Suspended Power Transmission Lines Inspection Robots	Zehra K. Küçük
17:15 - 17:30	Electrochemical Behaviors of Ti-6Al-4V Alloy Manufactured by Electron Beam Melting (EBM) Technique	Hakan Yilmazer
17:30 - 17:45	The 3D printing technology in stereometry training	Penio Dimitrov Lebamovski
17:45 - 18:00	Development of an intelligent control system for the exploitation of knowledge of a real industrial process	Hanane Zermane
18:00 - 18:15	Prediction of the Amount of Cement Material in An Algerian Cement Plant	Hanane Zermane
18:15 - 18:30	Effect of Beta Annealing Heat Treatment on Corrosion Behavior of Ti-6Al-4V Alloy Manufactured by Selective Laser Melting (SLM) Technique	Hakan Yilmazer
18:30 – 18:45	Investigation and characterization of PLA and ABS materials for 3D printed parts for auto industry	Mehtap Köse Moran
18:45 – 19:00	The effect of lattice structure on the product mechanical strength in 3D printer technology	Mehtap Köse Moran
19:00 – 19:15	Ag Powder Reinforced PLA Based Biocomposite Filament Manufacturing and Characterization	Resul Sönmez

23 November 2022	**Design, Modelling and Analysis, Application Fields**	
	For login please join on your computer, mobile app or room device **Click here to join the meeting** Meeting ID: 386 541 761 029; Passcode: fga4ao	
Time	**Title**	**Presenter**
Chaired by: ***Dr. Oguzhan Gündüz and Dr. Hakan Yılmazer***		
8:30 – 09:00	3D Bioprinting of Living Tissues and Organs	İbrahim Tarık Özbolat
09:00 – 09:30	Control of Crystallographic Texture in Powder Bed Fusion AM of Metals for Biomedical and Industrial Applications	Takayoshi Nakano
09:30 – 10:00	Advancement in Biomaterials and their applications in biomedical fields	Ankita Awasthi
10:00 – 10:30	Direct energy deposition of functional materials via Laser Additive Manufacturing / 3D printing: process modelling versus experimental validation	Ion Mihăilescu

10:30 – 10:45	An example of using game design in education in terms of industrial design: the "build your own rocket" project and analysis of rocket model printing with 3D printer	Celaleddin Kaleli
10:45 – 11:00	Analysis of 3D printed gears strength using image processing method	Murat Aydin
11:00 – 11:30	**Coffee break**	
11:30 – 11:45	Effect of slope angle to thermal deformation on the non-planar surface of hybrid large-scale additive manufacturing	Mehmet Aladag
11:45 – 12:00	Integration of industrial Delta and articulated arm robots in automation cells	Mihai Costea
12:00 - 12:15	Optimization of freeze dryers	Mujtaba Abbakar
12:15 - 12:30	Development of tank valve for water treatment device	Hakan Maden
12:30 – 12:45	Application of Biomimetic Based Lattice Structures to Topological Optimization	Nur Zeynep Cengiz Bulut
12:45 – 13:00	Sediment breaking filter design for individual floor heating natural gas installations	Hatice Evlen
13:00 – 14:00	**Lunch**	
Chaired by: ***Prof. Filiz Ersöz and Dr Hanane Zermane***		
14:00 - 14:15	Optimization of Dimensional Accuracy 3D Printing Manufacturing Parameter in PLA Material Samples By Image Processing Techniques	Batuhan Efendioglu
14:15 - 14:30	Numerical Modelling Of Heat Distribution In Powder Bed Fusion Process	Oğulcan Eren
14:30 - 14:45	Development of air purification device with UV-C	Hakan Maden
14:45 - 15:00	Optimization of machine parts models for 3D printing	Alexey Voropay
15:00 - 15:15	Coating of Additive Manufactured Lattice Structures: A Case Study with Electrophoretic Deposition	Doruk Gürkan
15:15 - 15:30	Continuous granule feed 3D printer	Mustafa Aydın
15:30 – 15:45	Risk Analysis in Istanbul and Iis Districts with Fine-Kinney Method	Taner Ersöz
15:45 – 16:00	3D Printing Industry Marketing Environment Awareness: Example of Education	Gözdegül Arik Karamik
16:00 – 16:30	**Coffee break**	
Chaired by: ***Prof. Mustafa Aydın and Dr Ishak Ertugrul***		
16:30 - 16:45	An experimental investigation about support remnants in laser powder bed fusion process	Orhan Gülcan
16:45 - 17:00	Investigation of electrical conductivity distribution of different materials	Ishak Ertugrul
17:00 - 17:15	3D printing of model and artistic ceramics: to revisit the pottery	Séverine A.E. Boyer

17:15 - 17:30	3D printing and Photogrammetry for a more accessible archaeological heritage. The case of painted ceramics of the Iberian tradition from Villares de Andújar (Jaén, Spain)	Alexis Maldonado Ruiz
17:30 - 17:45	A study on the applications of additive manufacturing technologies in the furniture industry	Neslihan Top
17:45 - 18:00	Additive Manufacturing in Fashion Design	Nur Zeynep Cengiz Bulut
18:00 - 18:15	Design Game in 3D Printer and CNC Machine, Play and Learn Mathematics	Gözdegül Arik Karamik
18:15 - 18:30	Effect of build orientation and surface post process on the tribological properties of MJF manufactured PA12 parts	Beyza Gavcar
18:30 - 18:45	Investigation of Mechanical Properties of Sand Casting Molds Produced by Binder Jetting 3D Printer	Ahmet Can
18:45 - 19:00	Manufacturing and Characterization of WAAM-based Bimetallic Cutting Tool	Uğur Gürol
19:00 – 19:30	Low-dimensional Materials for 3D Printing	Michael Bozlar
19:30 – 19:45	Development of 3D printing in the food industry	Harm-Jan Steenhuis
20:00 – 20:30	**Closing Ceremony**	

22-23 November 2022

POSTER SESSION		
Time	**Title**	**Presenter**
All Day	Co-Culture Bioprinting Of Tissue-Engineered Bone-Periosteum Biphasic Complex To Repair Critical-Sized Skull Defects In Rabbits	Qingfeng Li
All Day	Using additive manufacturing technology to produce clear aligners	Anita Fekonja
All Day	Machine Learning for predictive maintenance of Naval Propulsion Systems	Abbes Derardja
All Day	The development of a department within our company focused on the search for the applicability needs of 3D printing technologies in western Romania and offering the services that are needed	Andrei-George Zimbru
All Day	Our scientific experience with 3D-printed interim prosthetic dental materials	Ana Maria Cristiana Ţâncu
All Day	Development of three-dimensional printed tablets with diclofenac sodium through hot melt extrusion and fused deposition modeling	Ioan Tomuta
All Day	Hydroxyapatite-collagen based scaffolds processed via robocasting	Laura-Mădălina Cursaru
All Day	Synthesis and characterization of wollastonite ceramics used in tissue engineering applications	Adrian Ionut Nicoara

Medical Applications for 3D printing
Digital Industry
Program - Control Technologies
Mechanical Properties of Filaments
Design, Modelling and Analysis
Application Fields

A STUDY ON THERMAL BEHAVIOUR OF A 3D PRINTER AND EXTRUDED MATERIAL WITH THERMAL IMAGING METHOD

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ABSTRACT

With the development of additive manufacturing (AM) technologies, the durability of the equipment used in printers has gained importance. One of the important effects on durability is the heat load on the printer components. 3D printers generally have equipment that operates under high-temperature conditions. Therefore, problems occur in 3D printer operating parts due to high-temperature conditions. Besides that, the quality of the printing needs to be supplied by uniform heat distribution on the layers of deposition material.

The aim of this study is to investigate the temperature distribution of the 3D printer and printed material while manufacturing the designed part. The manufacturing process is performed by a commercial 3D printer that prints with fused deposition modelling. The manufactured part is created as a hollow cylinder. Thus, thermal distribution on the 3D printer and printed material can easily be observed and thermal distribution was homogeneous. Thermal images have been obtained with a thermal imaging camera. For the hollow cylinder, temperatures at four different layer levels (25%-50%-75%-100%) are measured with the thermal camera and data recorded. Two different experimental setups are established for this study. One of them is, non-isolated from ambient conditions, another setup is isolated from ambient conditions. The differences in temperature distribution are investigated with these two setups. As a result of this study, thermal behavior and temperature distribution between printed deposition material, printing platform and 3D printing components are obtained concerning time.

Keywords: 3D Printing. Additive manufacturing. Thermal imaging. Temperature distribution.

AN EXPERIMENTAL INVESTIGATION ABOUT SUPPORT REMNANTS IN LASER POWDER BED FUSION PROCESS

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ABSTRACT

Support structures are used especially in overhang surfaces in laser powder bed fusion process to reduce dimensional deviation and surface roughness. However, remnants are observed on the overhang surfaces after removal of support structures which need to be removed from the surface via some conventional or non-conventional means. Therefore, it is important to reduce the support remnants to ease post processing after laser powder bed fusion process. In the present study, support remnant heights were evaluated in terms of support thickness and support spacing for laser powder bed fusion produced overhang parts from Inconel 718 material. Experimental studies revealed that both support spacing and support thickness have influence on support remnant heights. It was observed that increasing support spacing decreased the support remnant height.

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OPTMIZATION OF MACHINE PARTS MODELS FOR 3D PRINTING

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ABSTRACT

When manufacturing machine parts using additive 3D technologies, we are faced with the task of choosing a specific manufacturing technology, material, and settings for the 3D printing process. These factors affect the manufacturing time, cost, accuracy, strength and other criteria for the performance of machine parts. Based on this, the purpose of the study is to develop recommendations for optimizing models of machine parts for 3D printing.

The study describes the main approaches to optimizing three-dimensional models of machine parts at the design stage. This optimization avoids a number of problems that arise when using various 3D technologies (FDM, SLA, etc.). Depending on the type of the designed part and the applied additive 3D technology, additional requirements and restrictions are imposed on the models. The issues of optimizing models in terms of 3D printing time, manufacturing cost, geometry (accuracy) of the resulting model are considered, and the issues of the strength of the entire part or its individual elements are also partially investigated. Specific design solutions and recommendations for the manufacture of rotation parts, in particular, shafts and gears, are given. The issues of occurrence of some defects associated with overheating, uneven cooling and plastic shrinkage are considered. The simplest models for studying critical parts for strength are described.

Recommendations have been developed for determining the properties of machine parts manufactured using additive 3D technologies for their design. This study will be of interest primarily to developers of 3D models and is designed to eliminate some of the problems that arise during 3D printing at the product design stage.

NATURE-INSPIRED DESIGN IDEA GENERATION WITH GENERATIVE ADVERSARIAL NETWORKS

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ABSTRACT

New, creative and innovative ideas that will be created in the early stages of the design process are very important to develop better and original products. Human designers may become overly attached to certain design ideas that hinder the thinking process towards generating new concepts in the process. This situation can prevent creating ideal designs. Finding original design ideas requires a creative mind as well as knowledge, experience and talent. In addition, verbal, written and visual sources of inspiration can be helpful, inspiring for generating ideas and concepts. In this study, a visual integration model was created by using a data-supported artificial intelligence (AI) method to generate creative design ideas. A generative adversarial network model (GAN) is proposed, which produces new creative product images inspired by nature with the combination of target object and biological object images. This model has been successfully applied to an aircraft design problem, tested and evaluated. The sketches obtained with the generative design model can inspire the designer to find new / creative design ideas and variants. This approach can increase the quality of the ideas produced, as well as make the idea and concept production process easy, simple and quick.

2D LATTİCE GENERATİON BY COMPUTATİONAL DESİGN METHOD

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ABSTRACT

During the design process, designers sometimes get stuck with wrong or dogmatic ideas, which can prevent them from finding ideal design solutions. In order to overcome this situation, designers can usually spend more effort and longer time. Although knowledge, experience, talent, and concentration help to overcome the aforementioned negativities to a certain extent, a limited number of new design concepts can be produced. In this study, the production of new design concepts with computer-aided computational design software has been examined and evaluated. Due to the great development and improvement in computer hardware and software over time, such systems have become important tools in all design fields and activities. With these computers aided computational design software that meets the design/designer requirements, an infinite number of alternative design concepts can be produced in a short time. A repeatable, dynamic process is created by converting all components of the design into parameters. With this proposed method, the generability of 2D lattice design concepts was evaluated. This method not only increases the quality of the design options generated but also enables the idea and concept production process to be realized easily, simply, and quickly.

PHOTOPOLYMERIZATION-BASED ADDITIVE MANUFACTURING OF ACTIVE MEDICAL DEVICES

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ABSTRACT

We have examined the use of many types of photopolymerization-based additive manufacturing technologies, including digital micromirror device-based stereolithography and two photon polymerization, to create small-scale medical devices for tissue engineering, transdermal drug delivery, and transdermal sensing. The nonlinear nature of two photon absorption facilitates the use of two photon polymerization for the processing of medically-relevant structures with features below the diffraction limit. For example, we have used additive manufacturing techniques to prepare hollow microneedles that may be used for the direct interaction between a sensor and subsurface tissues. Several types of electrochemical and optical sensors have been integrated with arrays of hollow microneedles. In addition, multiplexed microneedle sensors may potentially be used for the simultaneous detection of several physiologically-relevant molecules. In this talk, recent efforts to improve photopolymerization-based additive manufacturing of medical devices and facilitate clinical translation will be considered.

3D PRINTING FOR TISSUE ENGINEERING APPLICATION

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ABSTRACT

Tissue Engineering, which includes many disciplines such as medicine, biology and engineering, aims to repair or re-establish lost functions in damaged bone structures. Three-dimensional (3D) artificial bone scaffolds used for the regeneration of organs and tissues take part in the creation of new tissue by creating the necessary contact points for the cell to perform its functions. It is still difficult to control the porosity ratio and interpore bonds, and obtaining inhomogeneous tissues has brought alternative production methods to the agenda In the conventional methods used in the production of artificial bone scaffolds. Thus, Additive Manufacturing, which is integrated with Computer Aided Design (CAD) software, has become a widely used production technology in tissue engineering applications. AM technologies allow the fabrication of complex artificial scaffolds with high porosity sensitivity, specially developed for damaged tissues, using biocompatible materials. In this study, new design strategies used in the production of artificial bone scaffolds with AM technologies were investigated. Tissue engineering applications using biomaterials and methods such as material extrusion, photopolymerization, powder bed fusion and material jetting, which form artificial bone scaffolds with different production techniques, are discussed. Besides, literature studies using CAD-based design methods for the design of 3D artificial bone scaffolds were evaluated.

ADDITIVE MANUFACTURING IN FASHION DESIGN

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ABSTRACT

Additive manufacturing (AM) is one of the modern manufacturing technologies. Since the 1980s, with the development of technology, its usage areas have been increasing and revealing the application potential in different sectors. Textile and fashion design are examples of these sectors. The use of 3D printing technology in fashion design and the textile industry has created an innovative perspective in the textile industry. Three-dimensional printing (3DP) allows the creation of complex products, providing the same freedom in the fashion design industry as it provides in other industries, and offers the possibility of personalization for individual users. In this study, 3D printing technology and the use of 3D printing in the fashion design industry are explained. The limitations of 3D printing in the fashion industry are mentioned.

APPLICATION OF BIOMıMETıC BASED LATTICE STRUCTURES TO TOPOLOGICAL OPTIMIZATION

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ABSTRACT

As a result of millions of years of evolution, nature has created structures that are resistant to current conditions. This evolutionary process of nature has always inspired designers and engineers and continues to be. People solve problems by being inspired by the structures that nature has created by evolution. When these inspired structures are examined, it is seen that they have complex geometry. The manufacturability of structures with this complex geometry is provided by additive manufacturing. Additive manufacturing technologies have been developing gradually since the 1980s, bringing freedom to design processes. In order to provide this freedom, the design for additive manufacturing (DFAM) design model has emerged, depending on the capacity of additive manufacturing technologies. In this design model, designs with high mechanical properties can be created by using lattice structures. The combination of these two methods allows the creation of bio-inspired designs. In this study, it is aimed to obtain a product with optimizing properties such as lightness, energy absorption and material reduction by considering a combination of biomimetic approaches and additive manufacturing design.

IMPROVEMENT OF FATIGUE STRENGTH OF 3D PRINTED Ti6AL4V BY MECHANICAL SURFACE TREATMENTS FOR MEDICAL IMPLANTS

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ABSTRACT

3D printed metals are attractive materials for medical implants, as required geometry can be made from CAD/CAM data directly. However, fatigue strength of 3D printed metals is very weak, and it is nearly half of bulk metals because of rough surface due to un-melted particles [1]. The big issue for 3D printed metals is the improvement of fatigue strength of 3D printed metals. One of powerful way to improve metallic material is mechanical surface treatment such as shot peening. Soyama et al. have been developed a new mechanical surface treatment, in which cavitation impacts are used, and it was named as "cavitation peening" [2]. Note that cavitation impact normally caused severe damage in hydraulic machinery, but it can be utilized for the mechanical surface treatment in the same way of shot peening without shots.

In the invited keynote lecture, the mechanism and the application of cavitation peening are revealed, and the improvement of fatigue strength of 3D printed Ti6Al4V by cavitation peening is demonstrated comparing with shot peening and laser peening. The used 3D printed Ti6Al4V was additively manufactured by direct metal laser sintering DMLS and electron beam melting EBM. The 3D printed Ti6Al4V specimens were treated by cavitation peening using the cavitating jet, whose injection pressure was 30 MPa, submerged laser peening and shot peening. In order to reduce surface roughness, grinding and cavitation abrasive surface finishing were also examined. The fatigue properties of specimens were investigated by a plane bending fatigue test. The fatigue strength of EBM was 169 ± 14 MPa and that of DMLS was 185 ± 9 MPa, which are half of the bulk Ti6Al4V. The fatigue strength of cavitating peening was 365 ± 8 MPa for DMLS and that of cavitation peening after grinding was 445 ± 8 MPa. The fatigue strength treated by submerged laser peening was 362 ± 8 MPa, and that of shot peening was 359 ± 5 MPa. Namely, the mechanical surface treatment combining cavitation peening and grinding was best, and it improved the fatigue strength by approximately 2.4 times of as-built specimen.

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BIO-MANUFACTURING HUMAN TISSUES IN VITRO: FROM FORMULATION TO APPLICATIONS

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ABSTRACT

Layer-by-layer additive manufacturing process, otherwise popularly known as three-dimensional (3D) printing, has attained significant attention owing to sophistication, customization, precision and scalable features that it offers. The technology has evolved into 3D 'BIO'-printing and has emerged as an innovative bottom-up tissue engineering approach aiming to bio-manufacture clinical scale tissues/ organs with intricate details. This fascinating computer-aided additive bio-manufacturing process typically involves extrusion of cell-laden hydrogels, popularly termed as bioinks, through a nozzle of definite diameter, and collection, or otherwise printing, on a platform in the form of a 3D structure of interest. Our lab works on the development of bioinks for biofabrication of various human tissues in vitro. This talk would cover an overview of the fundamental concepts in the field, including historical background, typical setup, work flow, insights into bioinks including ideal characteristics of a bioink, as well as an overview of the 3D bioprinting activities at our laboratory. Our experience tells us that the 3D bioprinting is a versatile approach with a great potential for bio-manufacturing of tissues for clinical applications.

NUMERICAL MODELLING OF HEAT DISTRIBUTION IN POWDER BED FUSION PROCESS

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ABSTRACT

The selective laser melting (SLM) method, in which complex three-dimensional parts can be created by selectively melting the powders in the desired location with the laser beam, is one of the most prominent metal additive manufacturing methods. Since the SLM method is based on the physical phenomena of and laser-matter interaction and thermal manufacturing, the temperature distribution caused by laser directly affects physical, microstructural, and dimensional properties of parts. In this research Finite Element Models (FEM) were established to predict temperature distribution of the build part. The moving Gaussian heat source is modeled to simulate the laser beam incident on the powder surface. The analyses have been conducted by using COMSOL software while taking the conduction, convection and radiation phenomena into account. To investigate the effect of process parameters on thermal distribution, varied laser powers and scanning speeds were used while beam diameter and powder layer thickness were kept constant. The results show that the dimension of the melt pool is significantly affected by laser energy density. Additionally, the reported negative impacts are addressed, including irregular melt pool formation, balling, and porosity. At the conclusion, recommendations and future works regarding how to employ the optimal parameters are provided.

MACHINE LEARNING FOR PREDICTIVE MAINTENANCE OF NAVAL PROPULSION SYSTEMS

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ABSTRACT

In recent years, Predictive Maintenance (PM) has assumed a very important place in the maintenance recommendation in the industry. Machine learning techniques are the best way to ensure this function. It has achieved many successes in this area of maintenance. One of the main tasks of machine learning, big data, and data mining is creating good models from datasets (historical labeled dataset collected from similar systems) to apply them in different contributions. In this paper, we aimed to construct a regression model for Predictive Maintenance based on Random Forest (RF) technique, which is one of the most popular techniques of machine learning. We performed a dataset on naval propulsion systems for trained the algorithm that was performed in our model. Compared to other machine learning techniques as Decision Tree (DT) and Support Vector Machine (SVM). Results obtained from the application of the RF algorithm show a higher level of accuracy in terms of the classification of new signals and observations of the naval propulsion systems. These results permit to gain time and economic costs of the equipment.

HYDROXYAPATITE-COLLAGEN BASED SCAFFOLDS PROCESSED VIA ROBOCASTING

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ABSTRACT

The bone is a material that has in its composition preponderantly a mineral phase called hydroxyapatite and an organic phase that consists in collagenic and non-collagenic proteins. Due to its outstanding properties, the hard tissue is able to self-repair in case of minor defects. Even so, in case of fractures with critical dimensions, the bone is no longer able to heal itself and the need for grafting material appears. It is well known that the hard tissue came to be the one of the most transplanted materials at a global level. Thus, a suitable grafting material is required. A good approach to obtain a synthetic graft for the bone defects could be to obtain a material that imitates the hard tissue composition. Simultaneously, a bone fracture can have various shapes, therefore a processing technique that facilitates the fabrication of a scaffold with a defect specific geometry could lead to outstanding results [1,2]. To this extent a promising method could be to obtain a biomimetic material based on hydroxyapatite and collagen. The composite material can be further processed using a 3D printing technology in order to ensure the personalization of the scaffold's geometry. The purpose of this study is to obtain a 3D structure with potential for bone tissue engineering by synthesizing a hydroxyapatite-collagen composite that will be further processed using the robocasting technology.

Hydroxyapatite-collagen powder is obtained using the hydrothermal route. The obtained material is then sprayed dried in order to ensure the optimum characteristics of the powder grains that will facilitate the 3D printing process. Further on, the obtained powder is mixed with different commercial additives in order to identify the ink with the adequate rheological behavior that will enable the 3D printing process. Finally, different 3D constructs with various shapes are obtained and further analyzed using scanning electron microscopy (SEM) in order to establish if the printing process parameters are respected. The result of this study indicates that the hybrid powder with good characteristics for the 3D printing is obtained successfully by the hydrothermal route. Furthermore, a paste with good viscosity is obtained and 3D structures that respect the printing parameters are processed via robocasting. In conclusion, the hydroxyapatite-collagen based material can be processed successfully via robocasting and scaffold with high potential in tissue engineering can be obtained.

ANALYSIS OF 3D PRINTED GEARS STRENGTH USING IMAGE PROCESSING METHOD

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ABSTRACT

Plastic gears are used as inexpensive, simple equipment widely used in machine systems such as clocks and small gearboxes. On the other hand, the printing of these gears with 3D printers shortens the production processes, but affects them negatively in terms of durability. In particular, the strength and root damage mechanisms of 3D plastic gears are still a subject of research. In this study, the deformation behavior of plastic gears under load and tooth root fracture mechanisms were investigated by image processing and damage mechanisms were investigated.

THE 3D PRINTING TECHNOLOGY IN STEREOMETRY TRAINING

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ABSTRACT

This paper presents a new stereoscopic system for teaching stereometry named StereoMV (Stereo Math Vision). It is authored and can be used to teach middle school students to develop thinking in three-dimensional space. This discipline, part of Euclidean geometry, creates the most difficulties for students—especially those with the least developed spatial imagination. One of the software's main features is that it can export geometric objects in a .obj file extension to print on a 3D printer or add to an augmented or virtual reality devices. Applying this technological innovation in the education sector will improve how students acquire new knowledge. Because in this way, learning mathematics will become fun, enjoyable, and valuable. Concepts that are difficult to understand will become not only visible but also tangible. One of the system's main advantages is that it fully uses the Java3D library, which enables the visualization of virtual reality systems with and without immersion. Thanks to a new author's method for generating geometric figures and a 3D library, it is possible to export geometric objects in a .obj file. The most widespread technology in low-budget 3D printers, such as a printer that can be used in schools, is FDM (Fused Deposition Modeling).

THE ROLE OF CRYSTALLOGRAPHIC TEXTURE ON GRAIN BOUNDARY CHARACTERISTIC DISTRIBUTION FOR DEFECT PREVENTION IN METAL ADDITIVE MANUFACTURING

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ABSTRACT

Since additive manufacturing (AM) is featured by its flexible shaping ability, it has been utilized for the fabrication of a variety of products with complicated three-dimensional structures. AM is expected to be suitable for near-net-shape processing of difficult-to-process materials, and its application to such metal materials has begun to be tested. In addition, recent studies have shown that laser powder bed fusion (LPBF) process, one of the AM techniques, is highly effective in controlling the crystallographic texture of various metallic materials, from randomly oriented polycrystalline to single crystalline-like microstructures and the resulting enhanced structural and functional properties. While optimized process parameters of LPBF process promoted crystallographic texture formation, single-crystal-like texture formation exhibited unique grain boundary characteristics which have a significant impact on the strength and ductility, cracking, and environmental effects. Therefore, it is important to understand the role of crystallographic texture formation on grain boundary characteristic distribution (GBCD) to successfully fabricate challenging materials, such as Cr and W which tend to crack due to their high ductile-brittle transition temperature.

An LPBF-machine (EOS M290, Munich, Germany) equipped with a 400 W Yb laser was used to manufacture the pure Cr and W specimens in a wide range of energy density (E), considering laser power (P), scan speed (v), powder layer thickness (h), and hatch space (d). Bidirectional laser scanning was performed under an Ar atmosphere with a rotation of 90° between layers (XY scan), and the baseplate was preheated to 80°C to up to 200°C. As-built specimens were analyzed by optical microscopy (OM), scanning electron microscopy (SEM) equipped with electron back scattering (EBSD).

The results of this study exhibited a strong correlation between texture strength and GBCD. Considering microstructure composing a single-crystal-like texture, high-angle grain boundary (HAGB) density decreased, and consequently crack initiation and propagation were prevented. Moreover, existing HAGBs showed lower misorientation angles which also promote crack-resistant GBCD. Thus, strengthening crystallographic texture is a promising approach to prevent severe cracking in hard-to-process materials and enhance the as-built density.

A STUDY ON THE APPLICATIONS OF ADDITIVE MANUFACTURING TECHNOLOGIES IN THE FURNITURE INDUSTRY

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ABSTRACT

Nowadays, rapid developments in Additive Manufacturing (AM) technologies have caused the manufacturing industry to compete with traditional manufacturing in many areas. AM technologies, which can be integrated into Computer Aided Design (CAD) software, come to the fore with the ability to produce a product whose Three Dimensional (3D) model is mostly prepared in a single process step. Besides, these technologies facilitate the production of multifunctional structures with complex geometry. Innovative 3D printing applications are seen in many different sectors such as medical, defense, automotive, education, furniture, jewelry, etc. Thus, in this study, the applications of AM technologies in the furniture industry were investigated. Considering the growing demountable furniture market, plastic furniture fastener designs produced with AM technologies come to the fore in this field. In the study, especially customized designs and different combination details and furniture fastener design examples were examined. Moreover, the advantages, disadvantages and future trends of different AM technologies used in the furniture industry are discussed in this study.

DOX-LOADED PLA TUMOR DRESSING DESIGN WITH 3D PRINTER FOR CONTROLLED RELEASE SYSTEMS

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ABSTRACT

Doxorubicin (DOX), an anthracycline antitoxin, is one of the effective chemotherapeutic anticancer drugs commonly used to treat various solid and hematopoietic tumors such as breast, ovary, cervix, prostate and leukemia. It is known that the rates of drugs used after intravenous administration of chemotherapeutic drugs are high and accordingly, their toxic effects are at substantial levels. It is aimed to decrease the rate of drug used within the scope of the study and to implant the decreased drug rate specifically to the tumor region. Polylactic acid (PLA), which has good biocompatibility and biodegradability and has been approved for use as a biomedical material by the US Food and Drug Administration (FDA), was chosen for this implantation process. In this study, DOX drug molecule, which is a chemotherapeutic anticancer drug; A tumor dressing was designed with a three-dimensional (3D) printer by combining it with PLA, which is easily converted into lactic acid and has no toxic effect when it implants in the body. PLA-DOX tumor dressing was designed as a controlled drug delivery system to suppress tumor growth and was produced with 3D printing technology. Fourier Transform Infrared Spectrometer (FT-IR) was used to determine the chemical bonds and bond interaction in the structure of the DOX-loaded PLA tumor dressing produced by 3D printing technology, and an optical microscope was used to verify the dissolution rate and pore structure of the DOX molecule. In vitro release test was performed for the tumor dressing produced. Finally, Scanning Electron Microscopy (SEM) was used to observe the morphological features of the 3D-printed PLA-DOX tumor dressing that were completed. These results demonstrated that 3D-printed PLA-DOX tumor dressing can be used as potential controlled drug delivery systems for cancer therapy.

Keywors: 3D printing, Doxorubicin, PLA, cancer, tumor

3D PRINTING APPLICATIONS IN BREAST CANCER

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ABSTRACT

Cancer continues to affect millions of people as a disease that is rapidly increasing and it is predicted that this increase will continue. The most common type diagnosed in women is breast cancer. Despite the fact that quite a lot of people are diagnosed with cancer today, the mechanisms behind cancer have still not been clarified. Although the entry of 3D printing into the scientific world is not too old, the potential of imitating biological environments effectively has begun to be investigated for use in the treatment of many diseases, especially cancer. Breast cancer needs a surgical operation. Before breast-conserving surgery, using a breast surgical guide produced by 3D printing to know the size and location of the tumor has an advantage in determining the boundaries of the tumor's spread. The ability of the breast tumor microenvironment, including the cell network and the extracellular matrix, to be produced in accordance with the natural tissue with cell-loaded bio-printing models helps to solve the mystery of cancer. In this way, cancer biology can be easily observed and drugs can be tested. In addition, the natural spread of cancer is being investigated with metastatic culture models. Although core needle biopsy is necessary to guide treatments, educational resources have limitations in many ways. In this case, the fact that breast phantoms for educational purposes can be produced and imagined in a reusable, realistic and affordable way with 3D printing constitutes a tremendous alternative. Rapid prototyping of tumor physiology by 3D printing increases efficiency and accuracy in the building of tumor spheroids. The production of bolus used in radiotherapy for the treatment of breast cancer by 3D printing can eliminate the dose mismatch. Additionally, the customizable and low-cost fabrication of drug-loaded scaffolds with 3D printing accelerates post-surgical breast tissue regeneration. The success rate increases in treatment with personalized medicines. 3D printing technology continues to develop in order to minimize the risks that may occur during application. In this literature review, the applications of 3D printing technology in the field of breast cancer are discussed with their advantages and disadvantages, also the future of these applications is envisioned.

Keywords: Cancer, Tumor, Breast Cancer, 3D Printing. Additive manufacturing.

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MATERIALS AND TECHNOLOGIES FOR 3D/4D PRINTING IN TISSUE ENGINEERING

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ABSTRACT

Tissue engineering has shown in recent years its excellent capability to tackle difficult problems in human body tissue/organ loss. In scaffold-based tissue engineering, porous scaffolds are seen to play vital roles for the seeded cells and for new tissue formation in the body. 3D printing provides a powerful manufacturing platform for different industries and has been increasingly used in the tissue engineering field. 3D printing technologies includes an array of technologies: liquid-based, filament (or paste)-based, and powder-based technologies. Using smart materials and with innovative designs, 4D printing produces dynamic structures that can change their shape, property, and/or function under external stimulus/stimuli. Using inks that contain living cells, 3D/4D bioprinting creates living structures for different purposes in the biomedical field. 3D printing technologies have greatly improved our ability to fabricate complex and customized biomedical products. However, finding or developing suitable biomaterials appears to be a bottleneck for the advancement of 3D/4D printing in biomedical engineering. Different 3D printing technologies have different requirements for the materials/inks to be used, and in most situations these requirements are highly demanding. We have been using the composite/hybridization approach in developing new biomaterials, and we have been investigating several 3D printing technologies, such as selective laser sintering (SLS), cryogenic extrusion 3D printing, and digital light projection (DLP), for fabricating advanced tissue engineering scaffolds and cell/scaffold constructs for the regeneration of bone, osteochondral tissue, blood vessel, etc. For example, for 3D printing of bone tissue engineering scaffolds via SLS, Ca-P/PHBV nanocomposite was developed. For cryogenic extrusion 3D printing of scaffolds for osteochondral tissue regeneration, β-TCP/PLGA nanocomposite was used. For shape-morphing scaffolds, β-TCP/PDLLA-co-TMC nanocomposite was developed. For obtaining complex shape-morphing structures, alginate and methylcellulose blends were investigated. This talk will present some of our work in developing different materials for 3D/4D printing in tissue engineering and innovating 3D printing technologies for tissue engineering applications.

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INVESTIGATION OF THE EFFECT OF LATTICE STRUCTURE ON THE PRODUCT MECHANICAL STRENGTH IN 3D PRINTER TECHNOLOGY

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ABSTRACT

The lattice structure (LS) in 3D printing technologies, is one the critical element that influences the mechanical strength of a produced part. It yields the parts with superior mechanical properties with optima area of use, different than parts made from a metal or composite material structure. The LS can also be considered as one of the basic elements that affect the weight and aesthetic appearance of the part. In 3D printer technology, especially in technologies that employ deposition, this LS can be organized and the part strength and weight can be adapted according to the part requirements. In this study, several geometries such as cubes, hexagons, octagons of LS were considered using the 3D printer technology with FDM method. The maximum considered work piece dimensions for this study were (250x220x220) mm t is 2 mm. The preparation and testing of the test specimens with a special screen carrier were performed for a specific automotive interior-trim manufactured for this study. In the experimental studies, various lattice structures were evaluated according to the requirements of the work piece. It was observed that there is good potential of manufacturing high quality parts with 3D printer FDM method. Key words: Lattice Structure, FDM, 3D printer

Keywords: Lattice Structure, Fused Deposition Modeling, 3D printer.

INVESTIGATION AND CHARACTERIZATION OF PLA and ABS MATERIALS FOR 3D PRINTED PARTS FOR AUTO INDUSTRY

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ABSTRACT

The mechanical properties of 3D printed materials are affected mainly by the printer technology itself, the lattice structure, the printing medium material choice and 3D system operating parameters. The material selection and their initial properties must be evaluated carefully for applications especially for automotive industry where high volume products with stringent quality requirements exist. Variations in performance in such industrial products are unacceptable and material properties from 3D printed products show satisfactory results in meeting the supplier, end user and customer requirements, special use scenarios. This study is examines the differences between the mechanical properties of ABS and PLA materials using the FDM production method with lattice structures, machine and materials. While revealing these differences, the selected material took the product used in the same place, the same user (test machine) and the same customer requirements (standards) as reference. The work output is to specify what should be considered in the process from the design stage to the end user of a product that is aimed to be manufactured using a 3D printer and offer the optima method.

Key words: Materials Properties, 3D printer, ABS and PLA

MANUFACTURING AND CHARACTERIZATION OF WAAM-BASED BIMETALLIC CUTTING TOOL

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ABSTRACT

Wire-arc additive manufacturing (WAAM) is a promising method to produce many functional components in different industries. In this method, the welding wires from the feedstock are melted by arc discharge and deposited layer by layer. Other welding wires having different chemical compositions can also be added to the top of the previously deposited layer by replacing the feed wire from the stock to produce bimetallic components. This study aimed to investigate the feasibility of using robotic wire arc additive manufacturing technology to produce bimetallic cutting tools. The bimetallic cutting tool was produced by depositing hard-facing welding wire on the austenitic stainless-steel wall produced with ER316 wire. The cutting-based equipment requires an increased abrasion resistance with the combination of ductility to provide adequate tool life and performance. Therefore, detailed microstructural analysis and hardness tests were conducted to understand the general microstructural characteristic of the manufactured cutting tool including interfaces between two different materials.

PREDICTION OF THE AMOUNT OF CEMENT MATERIAL IN AN ALGERIAN CEMENT PLANT

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ABSTRACT

Factories are currently confronted with multifaceted challenges created by rapid technological Many technologies have recently appeared and evolved, including Cyber-Physical Systems, the Internet of Things, Big Data, and Artificial Intelligence. Companies established various innovative and operational strategies, there is increasing competitiveness among them and increasing companies' value. A smart factory has emerged as a new industrialization concept that exploits these new technologies to improve the performance, quality, controllability, and transparency of manufacturing processes. Artificial intelligence and Deep Learning techniques are revolutionizing several industrial and research fields like computer vision, autonomous driving, predicting failures, etc. The idea of this work is the development of a predictive model to predict the amount of raw material in a workshop in a cement factory based on the Deep Learning technique Long Short-Term Memory (LSTM). The excellent experimental results achieved on the LSTM model showed the merits of this implementation in the production performance, ensuring predictive maintenance, and avoid wasting energy.

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SEDIMENT BREAKING FILTER DESIGN FOR INDIVIDUAL FLOOR HEATING NATURAL GAS INSTALLATIONS

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ABSTRACT

In this study, it has been emphasized that the combi return line filter in a house heated from underneath with individual natural gas combi system is frequently complained of clogging. It has been determined that the reason of congestion in cleaning operations after congestion is lime deposits of various sizes coming from inside the installation. The problem persisted despite the fact that the heating installation was cleaned with descaling chemical materials. In this study, vessel designs separating sediment and other foreign particles from the installation were carried out. Concept design and concept scoring matrices are used to design prototypes. Positive results were obtained in the experiments.

AN EXAMPLE OF USING GAME DESIGN IN EDUCATION IN TERMS OF INDUSTRIAL DESIGN: THE "BUILD YOUR OWN ROCKET" PROJECT AND ANALYSIS OF ROCKET MODEL PRINTING WITH 3D PRINTER

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ABSTRACT

Science Centers are educational environments that include systems that aim at children's learning by doing and experiencing scientific facts and are based on active learning. "Build Your Own Rocket" was considered in this study. The user group of the exhibition is 5-12 age level. Designing your dream rocket from assemblies as a modular Thermoplactic Polyurethane (TPU) modular with a 3D printer and build an installation in an assembler. It stores potantial energy between 2-4 bars in the air with a pneumatic piston. It is recovery for launching by starting to launch. Meanwhile, he initiates the retreat as a rocket launch video to train. When the countdown is over, the presured air, is released by a valve and the model rocket is launched in a protective tube. The height of the rockets is measured with the help of a laser sensor, and it gives information about the maximum height of the rocket model. Users learns some knowledge about the rocket scence depending on the users design and the potential energy they can accumulate. Numerous alternative rocket models can be developed from rocket parts printed from TPU filament in 2 colors and 12 different models. The soft texture of the rocket models is to prevent injury to the user and the rockets falling to the ground not to disturb the users by making a lot of noise. For this reason, in this study, using 3d printers with TPU as an alternative to soft-textured sponge, such as eva, is an alternative production method and can be considered good.

INVESTIGATION OF ELECTRICAL CONDUCTIVITY DISTRIBUTION OF DIFFERENT MATERIALS

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ABSTRACT

Although there are many techniques in process imaging, gamma, microwave, electrical and ultrasonic techniques are the most preferred ones. The most significant advantage of tomographic methods is that they provide more comprehensive information about the industrial process than traditional sensor methods. In addition, in tomographic processes, measurements are made without contact. This process is carried out by measuring the currents and voltages on the surface due to the voltage applied to the object. In this study, impedance tomography simulation studies were used to visualize the electrical conductivity distribution on an object. The model developed in the Comsol Multiphysics shows how to determine the shape and arrangement of objects with different material properties inside a box from the outside. Applying electrical voltage to the box allowed a surface charge density and electric field to vary depending on the permeability distribution inside the box. Thus, the effect of electrical conductivity on the surface charge density was investigated. As a result of the simulation studies, it has been seen that the surface charge density is higher, corresponding to the materials with higher permeability. As the applied voltage value increased, significant increases were observed in the surface charge density and the electrical field. The highest surface density was calculated as 188 pC/m^2 when 10V voltage was applied.

THE DEVELOPMENT OF A DEPARTMENT WITHIN OUR COMPANY FOCUSED ON THE SEARCH FOR THE APPLICABILITY NEEDS OF 3D PRINTING TECHNOLOGIES IN WESTERN ROMANIA AND OFFERING THE SERVICES THAT ARE NEEDED

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ABSTRACT

Observing the need for the development of the areas of applicability of 3D printing in several regions in Romania, we decided to take the step towards the area of 3D printing technologies. In the near future, we plan to develop a new department focused on medical 3D printing solutions. We believe this field needs to be expanded and provides the medical industry with great design freedom, adaptability, and functional integration. Our goal is to provide custom products and solutions to patients in the western part of Romania, as well as in the rest of the country. It is possible to manufacture prostheses, orthoses, and dental implants directly from the patient's individual anatomical data using additive manufacturing, so that the products will be available as quickly as possible, thus improving healing and prognosis.

OXIDE LAYERS DEPOSITED BY INKJET PRINTING

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ABSTRACT

The inkjet printing is a relative new, versatile and inexpensive technology, belonging to the additive manufacturing class of printing technologies. It is used for printing microelectronic components, circuits, microelectromechanical systems (MEMS), along with many other applications in medicine, house holding industry, etc. Uniform, compact CuOx layers (x = 0…1, depending on the processing steps applied after deposition) were successfully digitally patterned on different substrates (e. g. glass, alumina, etc.) by inkjet printing of an ink containing copper acetylacetonate dissolved in a solution of ethylene glycol. Work conditions, control of stoichiometry and implicit of properties, physico-chemical characterization of the oxide layers deposited and applications of them (especially for MEMS–like devices) are presented in the work.

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INVESTIGATION OF MECHANICAL PROPERTIES OF SAND CASTING MOLDS PRODUCED BY BINDER JETTING 3D PRINTER

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ABSTRACT

The use of the additive manufacturing method in the casting industry is increasing day by day. The production of reverse angled and complex shaped casting parts, which cannot be produced with the classical modeling technique, can also be produced very easily with this method. On the other hand, it is very fast, especially in terms of rapid production of prototype castings, which can be directly molded without the need for model production. In this study, a 3D Printer with binder jet was designed and produced firstly. 3D Printer; It consists of 3 parts, the main chassis, the sand spreader and the spraying part. In this printer, which was produced afterwards, sand molds were produced with different nozzle advance speeds, different catalyst ratios and sand grain sizes. The consumables used in the production of sand molds are silica sand, furan resin and catalyst. The mechanical properties of the produced samples were determined by performing compression and gas permeability tests. Afterwards, it was determined which of the produced samples were more suitable for a sand casting mold by comparing the results obtained from similar studies in the literature. In this study, a new printer was designed with direct spray technique without using cartridges and preliminary studies were carried out successfully.

INTEGRATION OF INDUSTRIAL DELTA AND ARTICULATED ARM ROBOTS IN AUTOMATION CELLS

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ABSTRACT

This paper deals with the design of structural elements necessary to the placement of suspended robots with parallel acting. At the same time, the design of a vacuum gripper, the conception and simulation of an industrial assembly cell is realized. The cell is equipped with two DELTA and one articulated arm robots, with serial architecture and close kinematic chain. The integrated DELTA robot is manufactured by ABB Robotics, being one of the fastest from his range. For the proposed structure a FEM analysis was carried out using rigid dynamics module from ANSYS code.

DESIGN GAME IN 3D PRINTER AND CNC MACHINE, PLAY AND LEARN MATHEMATICS

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ABSTRACT

The game is an important tool both in learning lessons and life itself. Students can adapt to gamification processes and internalize them. The game, which is an important tool in teaching mathematics, both supports mathematical process skills and helps students learn while having fun. It is also important for students to combine technology and games for mathematics teaching. The aim of this study is to develop the games that secondary school students can create on a 3D printer and CNC (Computer Numeric Control) Machine and to reveal which skills this process develops mathematically. The study was prepared with a case study, which is one of the qualitative research methods. The study group was formed with an easily accessible sample and was carried out with 12 students at 7th grade. In the study, data were collected with observation form, diagnostic form, and focus interview form. A six-week practice was carried out with the participants. In the first week, the usage information of the 3D printer and CNC Machine was introduced by the researcher. In the second week, it was discussed how to draw the determined games with Scratch and what to pay attention to. In each of the next four weeks, a game material was developed by the students, and products were presented on a 3D printer and CNC Machine. After the application, descriptive and content analysis of the data was carried out. It was stated by the students that the use of 3D printers is more surprising, exciting, and easier than the use of CNC Machine. It was observed that the students' estimation skills, mathematical reasoning skills, and problem-solving skills increased, while their mathematical communication skills increased in games and decreased in the use of 3D printers and CNC machines. It is stated by the students that their mathematical communication skills have decreased due to their desire to deal with the printer and the machine alone.

3D PRINTING INDUSTRY MARKETING ENVIRONMENT AWARENESS: EXAMPLE OF EDUCATION

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ABSTRACT

In these times when the rules of the economy are being rewritten, the education sector is seen as the biggest market in the new economy, along with a few other markets. With the innovative era of the digital world, the use of 3D printers in the education sector is increasing day by day. This increase gains momentum with the awareness, practices, and products created by the educators who are in the kitchen of the business. The markets for 3D printers, which provide flexibility, low cost, and time advantage, are changing and developing depending on new needs. At this point, it is possible with the analysis of these factors that the purchasing behaviors of educators are shaped by the macro/micro elements of the marketing environment. The aim of this study is to evaluate the micro/macro elements of the marketing environment of 3D printers for the education sector and to reveal the reasons that determine these elements. The study, which was carried out with the scanning model aiming to describe a situation in the past or present as it is, was carried out with 447 people working in the education sector. Teachers from different branches (145 people), assistants of school principals (108 people), school principals (112 people), and academicians (82 people) participated in the research. The research data were collected on the online platform with the help of a tool prepared by the researchers and consisting of three parts. The data collection tool was shared with experts in the field (3 marketing and 2 education), feedback was received and necessary corrections were made and shared with the participants. In the analysis of the data, descriptive and content analysis were used. As a result of the analysis of the research data, the economic environment factors; gross national product, interest and inflation rates, the general level of wages, employment, and money value policies are categorized by education workers. It is seen that the macro awareness of the education sector for the 3d printer industry is low and the micro-environment awareness is high, and this differs according to the branches.

OUR SCIENTIFIC EXPERIENCE WITH 3D-PRINTED INTERIM PROSTHETIC DENTAL MATERIALS

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ABSTRACT

3D-printed materials are extensively used in dentistry for obtaining various interim and final prosthetic restorations, mock-ups, splints, surgical guides, orthodontic devices, and dental models. The aim of this paper was to present certain aspects regarding both the biocompatibility and mechanical behavior of 3D-printed interim prosthetic materials, which have emerged from our recent scientific studies. Properties of PMMA (poly(methyl-methacrylate))-based interim prosthetic materials obtained by additive manufacturing (AM), subtractive manufacturing (milling technology) and conventional methods, in terms of their cytotoxicity (interaction with gingival cells, fibroblasts, oral keratinocytes), monomer release, and influence on salivary redox status, were outlined in this study, in a synthesis resulting from scientific literature exploration. Additionally, a comparative evaluation of the mechanical behavior (compressive and flexural strength) of 3D-printed and conventional resins used to obtain interim dental restorations was also exposed in this paper. PMMA-based interim prosthetic resins (conventional or modern ones) interact with the oral environment in a complex manner; different aspects related to possible adverse oral effects caused by these materials were synthetized. Regardless of the fairly considerable number of recent scientific papers on the use of 3D-printed materials in dentistry, there is a low amount of data corresponding to their biocompatibility. The chemical compositions of the 3D-printed materials are not yet completely provided by the producers, therefore, comparing different available studies' results was particularly challenging. On the other hand, all the interim prosthetic materials that we investigate in the performed mechanical tests showed appropriate mechanical behavior, withstanding forces comparable to those acting during the physiological masticatory process. PMMA, which is usually included in the composition of conventional interim prosthetic materials as well as in modern ones (3D-printed or milled), has already proved its clinical performance in the context of obtaining predictable final prosthetic results; its interaction with the oral environment continues to be a subject of great interest and debate in the scientific world. The tested 3D-printed interim resins obtained better results than the conventional resins in the performed compression and flexure tests.

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3D PRINTING AND PHOTOGRAMMETRY FOR A MORE ACCESSIBLE ARCHAEOLOGICAL HERITAGE. THE CASE OF PAINTED CERAMICS OF THE IBERIAN TRADITION FROM VILLARES DE ANDÚJAR (JAÉN, SPAIN)

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ABSTRACT

In recent years, in the field of Archaeology, the use of 3D Printing technologies for the conservation and dissemination of heritage is becoming more and more frequent. Efficiently combined with digitization technologies such as laser scanning or Structure from Motion photogrammetry, the new 3D printers allow digital reality to be reintegrated in very diverse materials and in a quite affordable way in many cases.

In this way, an exact digital replica obtained by photogrammetry, can be returned to its tangible format with sub-millimeter precision. And not only that, but the original piece can be adapted prior to printing to the needs of certain groups, as is the case of people with blindness or low vision. In this sense, 3D printing becomes an exceptional way of bringing, not only the present, but also the past closer to groups of people who traditionally have not had access to it.

We show a clear example of this with the typhlological adaptation of some fragments of painted pottery of the Iberian tradition from the archaeological site of Villares de Andújar (Jaén, Spain). This ceramic type, common in the south of the Iberian Peninsula between the last years of the 1st century B.C. and the 1st century AD. It presents a type of painted decoration impossible to perceive by touch. Through digitization, digital modeling and 3D printing we have created replicas where the decoration is raised by means of digital appliqués or highlights, thus achieving that it can be perceived as a relief.

3D PRINTING OF MODEL AND ARTISTIC CERAMICS: TO REVISIT THE POTTERY

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ABSTRACT

The experience around two fundamental stages in shaping by 3D printing is presented, i.e. the definition of a 'model' ceramic, and its "drying sequences" and "high temperature curing and sintering". The choice of the corresponding temperatures was driven by fine inspections of the TGA and the TMA curves. The 3D process used is a Pressure-Assisted Deposition Modelling (PADM), by deposition of different doughs. This step requires prior control of the formulation of the ceramic to be printed. The formulation influences both the deposit of material during the 3D printing step itself and the final "high temperature treatments" stage. We made the bet to use kaolin clay in its pristine hydrated state, i.e. without any chemical additions (or improvers), as "a model material". The ability to produce controlled structures with freedom in 3D-design by PADM is discussed. Our approach is intended to be "so-called green and eco-responsible" for "green ceramic" (qualified as a preform), which will then undergo a consolidation thanks to selected heat treatments.

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DEVELOPMENT OF THREE-DIMENSIONAL PRINTED TABLETS WITH DICLOFENAC SODIUM THROUGH HOT MELT EXTRUSION AND FUSED DEPOSITION MODELING

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ABSTRACT

Three-dimensional printing (3DP) technology is currently promoting enormous innovation in the pharmaceutical industry by enabling the production of custom-made personalized medicines. In this context, the aim of this study was to develop modified-release 3D-printed dosage forms, using custom made filaments loaded with diclofenac sodium (DS). The printed tablets were developed by implementing quality risk management (QRM) strategies combined with design of experiments (DoE), as specific tools of the Quality by Design (QbD) approach. Filaments with adequate FDM-3D printing characteristics and modified drug release were produced via hot melt extrusion (HME). Their formulation included the active substance (DS), polyvinyl alcohol (PVA) as the matrix forming polymer, different types of plasticizers (mannitol, erythritol, izomalt, maltodextrin and PEG) and super disintegrants (crospovidone and croscarmellose sodium). The physicochemical and mechanical properties of the extruded filaments were investigated through differential scanning calorimetry (DSC), X-ray diffraction (XRD) and maximum elongation measurements. The shape dynamic of the produced dosage forms was investigated by printing disk-shape cylindrical and tube 3D-dosage forms and the dissolution behavior of the developed printed dosage forms was assessed via various drug release kinetic models. DSC and XRD diffractograms revealed the incorporation of the initially crystalline active substance as amorphous dispersions into polymer matrix. Dissolution results of 3D printed tablets in acidic medium showed that the pH dependent profile of diclofenac sodium wasn't affected by its amorphous dispersion within the water soluble PVA, tablets geometry or the addition of super disintegrant. Additionally, erythritol and crospovidone were defined as adequate excipients to produce 3D printed tablets. The drug release kinetic for 3D-printed tablets was fitted with Korsmeyer-Peppas model and the novel tube design, which was suggested in order to increase the drug release rate, proved the opposite after performing the in vitro dissolution study. Finally, the present work demonstrates the potential to combine HME and FDM-3D printing techniques to produce various tailored made drug delivery systems with desired release kinetics.

DIGITALIZATION IN INTERIOR ARCHITECTURE AND PRODUCTION OF ARCHITECTURAL LAND MODELS WITH 3D PRINTERS

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ABSTRACT

Three-dimensional (3D) printer technologies are a production method that allows the production of free-form and complex geometric objects based on the method of creating and superimposing materials in layers, in contrast to the chip removal principle in traditional manufacturing methods. Due to the different material, mechanical and geometric properties of the products, various 3D printer technologies have been developed and commercialized and introduced to many sectors such as automotive, aviation, biomedical, medical, food, architecture, education. In this study, there are examples of applications of 3D printer technologies in the field of architecture, along with the method of producing a land model. This study was held within the scope of the ”Rapid Prototyping and Printing Technologies" course in Antalya AKE University Department of Interior Architecture and Environmental Design with the 2. class. In the study, respectively, the location of the selected terrain was determined in Google Earth, SketchUp, AutoCAD 2022, Fusion 360 software, the slope was created, the top-ups of the slopes were determined and finally the modeling was done. The terrain models modeled in scale were produced on FDM type Creality Ender 3 V2 3D brand 3D printer.When the land model is made with traditional methods, it is seen that the cost of the model is quite high compared to digital production. In the same way, when the two methods are compared, time saving is clearly seen in digital production when time study is performed. When making a land model in the traditional method, the abundance of inert materials attracts attention. In digital production, there are very few inert materials. Digital transformation applications are also taking their place in the field of interior architecture. While this study has opened the horizons of interior architecture students, it has brought awareness to the integrated process of digital transformation.

ESTIMATING SAFETY NUMBERS OF SLOPES WITH ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

Artificial neural networks (ANNs) are computer systems that allow the ability to automatically examine skills such as revealing and discovering new information based on the learning nature of the human brain without the need for help. These networks provide successful results in learning, reconciling, segmenting, generalizing, optimizing by using the products revealed by real brain functions. In this study, it is focused on investigating the results of slope stability analysis with artificial neural networks. First of all, 135 slope stability investigations with different cohesion and internal friction angle values were performed and the minimum safety numbers were determined according to the Simplified Bishop method. Then, the strength values of the ground were defined as input parameters, the safety numbers obtained as a result of the analyzes were defined as target parameters, and artificial neural networks were trained under the feed-forward backpropagation network type. With the simulation studies, ANN was asked to estimate the safety number of the slope under certain internal friction angle and cohesion values. The predictions made are compared with the stability verifications and the usability of artificial neural networks in slope engineering has been demonstrated.

E DEVELOPMENT OF 3D PRINTING IN THE FOOD INDUSTRY

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ABSTRACT

Additive manufacturing embarked in the 1980s and had limited applications over a long period of time. Gradually additive manufacturing has found increasing uses in a variety of industries such as the medical services and the construction industry. One industry that has received increasing attention is its applications in the food sector, such as pasta, chocolate, candies, and customized meals for people with special nutrition needs.

The paper describes the main additive manufacturing technologies that are applied in this industry, the materials that are being printed, and the main companies. How additive manufacturing promotes innovations and competitiveness in the food sector is also examined as well as business strategies to survive the competition. Challenges facing this emerging technology are identified to make strategic recommendations.

AN OVERVIEW OF BLOCKCHAIN AND IOTA TANGLE IN THE INTERNET OF THINGS

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ABSTRACT

Since the Internet of Things (IoT), which has become one of the most important technologies of today, can connect objects to the Internet, communication between processes, humans and machines has become possible. The Internet of Things can also be thought of as a global network that provides two-way communication by providing a unique identity to each object. Physical objects can collect and share data with minimal human intervention through cloud, big data, low-cost computing and mobile technologies. Blockchain technology, which is a partially new technology, can be used as a secure data provider in IoT applications. Blockchain is defined as a securely shared and decentralized distributed ledger of data. Besides, it allows a common group of users to share data. After Blockchain, IOTA Tangle technology emerged. Since it is a new technology, it has less use than Blockchain and is becoming increasingly common. The transaction costs, low transaction speeds and difficulties in IoT adaptation in the blockchain highlight the IOTA Tangle as an alternative. IOTA Tangle is an innovative type of distributed ledger technology (DLT) focused on IoT solutions that provides high scalability, free transactions and almost instant transfer. Within the framework of the Internet of Things, Blockchain and Tangle systems were examined, and it was aimed to investigate the similarities-differences, advantages-disadvantages and also usage areas between both systems.

OPTIMIZATION OF FREEZE DRYERS

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ABSTRACT

Freeze drying is a drying technique that uses the sublimation as a means of drying. This process is one most effective ways of drying materials. Though the process might dry the product effectively, the process is often expensive and long. So continuous optimization of freeze dryers is needed to further improve the drying industry. This paper focuses on the mechanical optimization of the operation. Mainly through the duct that connects the drying chamber to the vacuum chamber. Five different models were designed and analysed using a CFD software to observe the H2O mass flow exiting the drying chamber, the temperature and pressure distribution across the drying plate. The results of the study showed that the physical location of the duct and the number of ducts plays an important role in the improvement of freeze dryers.

3D BIOPRINTING OF LIVING TISSUES AND ORGANS

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ABSTRACT

3D Bioprinting is a disruptive technology enabling deposition and patterning of living cells in order to manufacture replacement tissues and organs for tissue engineering, regenerative medicine, disease modeling and drug screening purposes. In this talk, Dr. Ozbolat will survey the emerging field of bioprinting and its impact on medical sciences. In the first part of his seminar, he will present a wide range of 3D bioprinting efforts in manufacturing of tissue/organ substitutes performed in his laboratory in the last 11 years. In the second part, he will present a new bioprinting technique, called aspiration-assisted bioprinting, and explain the underlying physical mechanism in order to understand the interactions between physical governing forces and aspirated viscoelastic tissue building blocks. Finally, he will demonstrate a new intraoperative bioprinting approach in order to repair composite soft/hard tissues during craniofacial reconstruction on a rat model in a surgical setting.

CONTROL OF CRYSTALLOGRAPHIC TEXTURE IN POWDER BED FUSION AM OF METALS FOR BIOMEDICAL AND INDUSTRIAL APPLICATIONS

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ABSTRACT

Metal additive manufacturing allows the creation of products with superior mechanical properties by simultaneously controlling the shape parameters and microstructural parameters. In other words, besides anisotropic/isotropic design that entails shaping the external and internal structures of complicated shapes by tailoring designs, it is possible to control the atomic arrangement to resemble that of a single crystal to achieve the desired mechanical properties in a specific direction. The powder bed fusion method of metal additive manufacturing provides a certain directionality; moreover, because the irradiation direction of the heat source beam and the stacking-layered plane are close to perpendicular to each other, high functionality products can be demonstrated in a specific direction by fabrication under optimal conditions. The shape parameters hierarchically include both external and internal shapes such as the microstructural and/or cellular shape and the arrangement of the solid parts. The important microstructural parameters are obtained by the selection of materials with different physical properties and different atomic arrangements such as polycrystalline, columnar-like crystalline, and single crystalline. Ultimately, it is possible to simultaneously control the hierarchical shape and a microstructure such as a single crystal. The most important feature of shape parameter control and hierarchical additive manufacturing technology is to enable the production of highly functional complex, arbitrarily shaped products. In addition, for the fabrication of the β-type Ti alloy bone substitute, not only the shape but also the microstructure, especially crystallographic orientation, can be simultaneously controlled by metal additive manufacturing of the powder bed fusion system. Especially by controlling the scan strategy, it becomes possible to control the single-crystal-like microstructure having a crystallographic texture in which the low elastic direction is aligned along a specific direction for suppressing stress shielding. In this presentation, I will explain the details of these recent finding about the mechanism of microstructural control through additive manufacturing technology. I will also introduce a novel AMed spinal cage configuration that achieves in vivo mechanical integrity as a devise/bone complex by inducing bone that mimicked the sound trabecular bone, hierarchically and anisotropically structured trabeculae strengthened with.

LOW-DIMENSIONAL MATERIALS FOR 3D PRINTING

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ABSTRACT

Low-dimensional materials have gained considerable interest for applications in 3D printing technologies. Examples of low-dimensional materials include carbonaceous structures such as graphene, or metal organic frameworks (MOFs), or MXenes. A key advantage of these nanomaterials resides in their unique ability to combine multifunctionality in terms of physical and chemical properties. In the first part of this presentation, we will describe the chemistry and physics fundamentals of some of the major low-dimensional materials, including graphene, MOFs, and MXenes. In the second part, we will provide a review of the most recent applications of these nanomaterials in the context of 3D printing. Finally, we will provide an overview of the current challenges and technological barriers in 3D printing using nanomaterials, and we will conclude by providing perspectives and future research directions to the scientific community.

ADVANCEMENT IN BIOMATERIALS AND THEIR APPLICATIONS IN BIOMEDICAL FIELDS

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ABSTRACT

Due to increased demand in the market for medical implants, biomaterials have become more and more popular in recent years. The speed at which the globe is expanding has an impact on how people live their lives. Orthopaedic, dental, and maxillofacial abnormalities are becoming more prevalent in an important portion of the population as they age. The need for biomedical implants technology has so sharply increased in order to provide patients with a better lifestyle in a very cost-effective manner. In terms of the global index statistics on medical travel, India came in fifth overall and second in Asia. This is due to the healthcare industry's improved services, the flexible research process, aid and subsidies provided by the Indian government, and more. People from both sides of border are travelling to India on medical visas because the cost of the bio-implant treatment there is relatively reasonable.

The present investigation provides a critical analysis of current biomaterial, development, and it's processing for biomedical applications. For their effective uses, the method for creating porous and solid biological implants was thoroughly discussed. Technologies including powder metallurgy, rapid prototyping, and 3-D printing have been suggested as promising approaches for the creation of porous, mechanically-tuned metallic and ceramic implants for use in medical applications.

To improve the bioactivity, mechanical capabilities, and corrosion and wear resistance qualities of implants, a novel engineering technique for surface modification, processing, and treatment also being addressed.

DIRECT ENERGY DEPOSITION OF FUNCTIONAL MATERIALS VIA LASER ADDITIVE MANUFACTURING / 3D PRINTING: PROCESS MODELLING VERSUS EXPERIMENTAL VALIDATION

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ABSTRACT

The printed layers' characteristics by direct energy deposition (DED) and induced residual and thermal stresses determine the fabricated parts' quality and mechanical-physical properties. The characteristics of the 1st printed layer's layer are estimated based upon DED parameters which was then converted to multiple layers via a hatch distance that controls the re-melting depth. Next, a 2nd model was applied to estimate the residual stresses within the deposited and substrate layers. An experimental validation is presented in the case of AISI 316L powder on AISI 321 substrate, which resulted in a solution with an accuracy of 10-15 % mean absolute deviation.

Finally, the Johnson-Mehl-Avrami-Kolmogorov (JMAK) model was used in a 3rd step to estimate the average grain size across the printed layer. The mechanical properties, including ultimate tensile strength, yield strength, and hardness, could be further estimated using the inferred average grain size. The developed approached was validated for single depositions of AISI 304 powder on steel substrates via a DED process. The average grain size was quantified using SEM images and the "Image-J" software. The mechanical properties predicted by the simulation model were cross-verified with Vickers hardness tests. It was demonstrated a strong correlation between experiments and computations, within the range of 10-15 % (grain size estimation) and 8-10 % (mechanical properties calculation). The defined models could assist experimentalists in quantifying and controlling the DED process for the future large-scale, scientifically and industrial applications.

EFFECT OF SLOPE ANGLE TO THERMAL DEFORMATION ON THE NON-PLANAR SURFACE OF HYBRID LARGE-SCALE ADDITIVE MANUFACTURING

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ABSTRACT

Hybrid large-scale additive manufacturing (Hybrid-LSAM) is a production method that emerges by combining the part produced with different production methods (milling, molding, etc.) and additive manufacturing. In this study, we designed a geometry using Bezier's curves, then produced a conventional subtracting production method (milling) and coated the surface of the shape with the additive manufacturing method in a single layer using acrylonitrile butadiene styrene (ABS) material. In order to carry out the printing, existing printing parameters (printing speed and lateral overlap distance) were researched in previous studies and were generated as a fully 3D toolpath. Consequently, in order to investigate the outputs, we took thermal images during printing, thus, it becomes possible to comment on the thermal deflection. Moreover, the raster angle is important in terms of thermal deflection. Following this, the non-planar surface was coated at two raster angles: 0° and 45°. The changes in terms of deflection in a positive and negative angle of slopes were investigated.

Keywords: Hybrid large-scale additive manufacturing, non-planar printing, conformal additive manufacturing, thermal deformation.

ELECTROCHEMICAL BEHAVIORS OF TI-6AL-4V ALLOY MANUFACTURED BY ELECTRON BEAM MELTING (EBM) TECHNIQUE

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ABSTRACT

Additive Manufacturing (AM) provides the ability to manufacture complicated parts with unique shapes and structures and developing functional materials. Titanium provides high density and hardness thanks to its hexagonal tight package structure. These properties can be strengthened with the contribution of alloying elements. AMed of Ti-6Al-4V alloys have been extensively studied because of such importance for industries. Ti-6Al-4V alloy has a significant role in the medical applications, defense and aerospace industries due to its high elasticity modules and high corrosion resistance.

The microstructure of Ti-6Al-4V parts produced by Electron Beam Melting (EBM) is much finer than the microstructures obtained by conventional manufacturing (CM). While the microstructure of Ti-6Al-4V parts produced by CMed is uniform, the microstructure of the parts produced by AMed is needle form. Production parameters of EBMed samples, the energy volume depends on the applied current value. Also, much finer grains and much denser parts are produced with an increase in the current value. In parts produced with EBM, one of the Powder Bed Fusion (PBF) AM methods, the thermal history takes place in a more complex way, because a molten layer has been formed on the solidified layer. Therefore, heat zones have been formed in the parts. The thermal history can be summarized in three stages. These three cooling stages determine the microstructures obtained by the EBM process. Consequently, such zones can lead heterogeneous microstructure. As considering direct relation between corrosion behavior and microstructural features such as grain, grain boundaries, phases, and defects it is seen that heterogeneity and defects in the structure adversely affect corrosion resistance.

The effects of EBM parameters on the microstructure and the corrosion behaviors of Ti-6Al-4V alloys have been investigated in this study. Microstructure of EBMed samples will be examined using optical microscope, and X-ray diffraction (XRD) analysis. Mechanical properties of the samples have been analyzed by microhardness measurement, and tensile testing. The corrosion behavior of the samples will be examined by open circuit potential (OCP) and potentio dynamics scanning (PDS) using 3 electrode corrosion testing in a 3,5% NaCl solution.

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DIGITAL TWINS IN MANUFACTURING

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ABSTRACT

The use of digital twins is becoming more widespread in the manufacturing sector due to applications such as product development, design customization, preventive/prescriptive maintenance, performance optimization and fault detection. Due to the complexity of the manufacturing process and large datasets involved, a digital twin requires the use of advanced modelling techniques and machine learning to create a dynamic virtual representation. This talk is focused on the feasibility of applying a digital twin to predict the behaviour of the fused filament fabrication (FFF) process for a low-cost 3D printer manufacturing PLA parts. A digital twin of the extruder assembly has been created in this work. This is the component responsible for melting the thermoplastic material and depositing it on the print bed. The extruder assembly digital twin has been separated into three simulations i.e., conjugate convective heat transfer, multiphase material melting and non-Newtonian micro-channel. The functionality of the physical extruder is controlled by a PID/PWM circuit, which has also been modelled within the digital twin to control the virtual extruder's operation. The digital twin simulations were validated through experimentation and showed a good agreement. The PWM output going to the ceramic heater from the 3D printer controller was captured using an oscilloscope and showed the same duty cycle as the one observed from the digital twin. An external data logger was used to record the temperature on the heat block and its comparison showed a difference of 5% compared to the simulations from the digital twin. A thermal imaging camera was used to capture the temperature distribution in the extruder assembly to validate the conjugate convective heat transfer simulation, that also showed a good correlation. The use of digital twins in manufacturing is becoming critical and 3D printers are a good option to test their feasibility before application in more complex systems. The results of this work show the effectiveness of a digital twin and the control it provides for the manufacture of products without trial and error. Parameters can be changed in the virtual digital twin to ensure that proper material flow will be achieved in the nozzle of the 3D printer without clogs or obstructions; thus, preventing blockages and enhancing the lifespan of the extruder.

OPTIMIZATION OF DIMENSIONAL ACCURACY 3D PRINTING MANUFACTURING PARAMETER IN PLA MATERIAL SAMPLES BY IMAGE PROCESSING TECHNIQUES

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ABSTRACT

In this study, it was investigated the dimensional accuracy of PLA material samples manufactured by using fused deposition modeling (FDM) which is one of the additive manufacturing methods using processing parameters such as the effects of printing speed, filling rate and nozzle temperature. For this purpose, the first layer images of the samples produced with different parameters obtained according to the Taguchi L27 experimental design using a 3D printer were taken images by three times. The CAD and the 3D printer manufacturing images of the samples were analyzed by Image Processing Techniques. After then, dimensional accuracy values of PLA material samples were obtained for each parameter. The effects of manufacturing parameters (printing speed, filling rate and nozzle temperature) on dimensional accuracy were determined by analysis of variance (ANOVA) and were optimized. The obtained results were compared with the literature.

DEVELOPMENT OF AN INTELLIGENT CONTROL SYSTEM FOR THE EXPLOITATION OF KNOWLEDGE OF A REAL INDUSTRIAL PROCESS

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ABSTRACT

Industrial systems are difficult to control and supervise efficiently because of The complexity of the production process. The aim is to automatically control in real-time as an alternative for operators as possible and highlight the importance of machine learning in the field of industry. Integrate SVM into the industrial supervision system in the cement factory (SCIMAT) permit the classification of different measurements coming from sensors to the Programmable Logic Controller (PLC) that indicates when the process is in good functioning or bad indicating that a default has occurred. These measurements are classified after training in three classes of level (low, medium, and high) that are classified in their turn into two classes (good and bad functioning). The three classes present the inputs of the fuzzy controllers. Based on this classification, the PLC makes orders for the industrial equipment. Then a regression of variation of measurements in real-time is carried out to predict the good or the bad functioning of the production line. In conclusion, the proposed approach innovates the complex supervision system to learn how to control and preserve the habitual linguistic language used by operators, react in the right way, and prevent critical situations.

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3D PRINTERS IN NEURAL TISSUE ENGINEERING

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ABSTRACT

One of the most remarkable technologies of the era we live in with the developing technology is 3D printers. 3D printing has made exciting progress in recent years. 3D printer technology is used in many fields such as medicine, dentistry, automotive, architecture, space and aviation. With the development of technology, 3D printers are integrated according to innovations and needs in the health sector. In the healthcare industry is developing day by day, 3D printers are used to restore, protect and develop tissues and organs, and there are potential impacts on them. It has many uses in health education. It is available to anatomical site selection, potential to develop next-generation surgical knowledge and skills and techniques to develop patient-specific models. In addition to this, 3D scanning technologies have started to take place instead of scanning technologies such as X-rays, CT, MRI used in the health field. Biocompatible materials are very important for cells and tissues not to generate toxicity. Biocompatible materials are very important to avoid toxicity in cells and tissues. The use of 3D printing technology together with biocompatible materials provides important developments in tissue engineering. 3D printing in tissue engineering, which allows the production of biological structures compatible with the complexity of the structure and geometry of the natural tissue, attracts great attention. 3D printers have begun to be used in the treatment and regeneration of tissues such as bone tissue, heart, skin, and neural tissue. The nervous system is the system that takes the body as a whole and obtains and processes information. The nervous system takes the body as a whole, receives and processes information. Nervous tissue is the main component of the nervous system. Any injury or disease that occurs in the nervous system can have serious and potential consequences. The damaged nervous system is very difficult to regenerate. The therapeutics used for the complete recovery of the nervous system cannot be sufficient. The use of 3D printers for regeneration of neural tissue is promising in treatment of neuronal disorders. In this area, studies are carried out to cellular regeneration by using polymer, biopolymer, copolymers or bioink materials with 3D printers. Recently, studies in this field have been progressing with very good results. In this review, the usage areas of 3D printers in neural tissue engineering will be discussed.

Keywords: Tissue regeneration, Neural tissue engineering, 3D printing, Bioprinting.

WEAR PERFORMANCE OF ADDITIVELY MANUFACTURED AND HOT ISOSTATIC PRESSED Cr

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ABSTRACT

Additive manufacturing technology enables a high degree of freedom for component shape, and the method provides much less raw material wastage with high efficiency in production resources. There are various additive manufacturing methodologies for metallic materials. Beyond other methods, Powder Bed Laser Melting (PB-LM) technology is one of the most common with its advantages. Besides the ability of complex design manufacturing of AM technology, PB-LM can modulate the product structure with production parameters. This can enhance specific material properties. High mechanical strength can be obtained with PB-LM with long processing durations. For optimal manufacturing, shorter processing durations are needed. However higher speeds result in pores in the structure. From that point of view, Hot Isostatic Pressing (HIP) has great potential as post-processing after PB-LM.

In this experimental study, pure Cr powders are used via different PB-LM processing parameters. Afterwards, the HIP process was applied to all samples under the same conditions. The mechanical material properties were characterized. Pin on disk tests was applied to samples. The wear performance and microstructure effect on the coefficient of friction were characterized and discussed.

EFFECT OF BUILD ORIENTATION AND SURFACE POST PROCESS ON THE TRIBOLOGICAL PROPERTIES OF MJF MANUFACTURED PA12 PARTS

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ABSTRACT

In recent years, the use of additive manufacturing (AM) in industry and research has rapidly increased. Without question, this technology will maintain its importance in the coming years thanks to the advantages on offer. Multi Jet Fusion (MJF) AM technology that is based on the powder bed fusion methodology provides engineering-quality parts having accurate dimensions and the finest details. This technique employs detailing and fusing agents by selectively depositing onto the powder particles in the droplet form and infrared radiation (IR) to fuse powder layers to achieve parts. Build orientation, which is one of the significant process parameter in MJF, affects the fatigue, mechanical and tribological properties of additively manufactured parts. The present study mainly investigates the effect of build orientation on the tribological properties of polyamide 12 (PA12) parts manufactured by MJF. To assess the effect of build orientation, samples were manufactured in three different build orientations (angled at 0, 45 and 90 degrees according to the X axis). Sandblasting and vibratory polishing post processes were performed. The density, surface roughness and microstructural characterization of polymer samples were measured. Tribological tests were carried out by ball-on-disc tribometer in dry sliding condition. Wear amount of the samples were determined by gravimetric method and the results were evaluated in terms of build orientation and surface post processes.

Keywords: Additive manufacturing, Multi Jet Fusion, Polyamide 12, build orientation, tribological properties.

COATING OF ADDITIVE MANUFACTURED LATTICE STRUCTURES: A CASE STUDY WITH ELECTROPHORETIC DEPOSITION

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ABSTRACT

Additive manufacturing (AM) which is a layer-based manufacturing method provide opportunity to generate porous geometries named as lattice structures. These structures have their own mechanical and topographical properties altered via unit cell type and lattice dimensions. By having bone-like porous geometries, lattice structures are widely used in biomedical implant manufacturing especially patient specific applications in different part of the body. Ti6Al4V is most widely used materials both for AM and biomedical applications. Although the porous nature of the Ti6Al4V lattice geometry enhances cell proliferation on the implant surface, it can be further improved by bioactive coating to facilitate bone cell formation and strengthen surface adhesion. Electrophoretic deposition (EPD) is one of the coating methods that is easy to setup and frequently used in bioactive coating applications. However, EPD has different process parameters which has to be optimized in accordance with substrate (lattice) geometry, coating material and desired coating properties. There are restricted number of study about EPD coating of the lattice structures and the process has not been fully understood. In this study, hydroxyapatite – chitosan (HA-CH) composite coating process of various Ti6Al4V lattice structures which are produced by laser powder bed fusion (LPBF) were investigated. The importance of pH and current (mA) parameters of the EPD process and lattice topology effect on the parameter optimization were discussed. The difficulties encountered in the coating process and the solutions developed for these difficulties were shared and the results were discussed.

EFFECT OF BETA ANNEALING HEAT TREATMENT ON CORROSION BEHAVIOR OF TI-6AL-4V ALLOY MANUFACTURED BY SELECTIVE LASER MELTING (SLM) TECHNIQUE

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ABSTRACT

Titanium and alloys are being used in aerospace industry, marine application, and surgical implants because they have a high strength, light weight, and cost-effective materials for wide variety of uses. The passive film on titanium is stable and easily repaired when damaged in oxygen-containing environments. Therefore, such Ti-6Al-4V alloy, which is most widely used Ti alloys, has an excellent balance between strength and corrosion resistance.

Additive manufacturing (AM) of Ti-6Al-4V alloy has been researched extensively, because play a vital role for these industries. Selective Laser Melting (SLM) is one of the Powder Bed Fusion techniques. The samples are solidified faster in SLM than the samples produced by produced conventional manufacturing (CM). As a result, the SLMed samples exhibits higher hardness and yield strength than those of CMed alloys. On the other hand, in SLM, production of layer-by-layer cause to changing hardness along the building direction. Ti-6Al-4V alloy has bimodal microstructure, so galvanic corrosion starts first where α/β phase boundaries. Furthermore, the SLMed Ti-6Al-4V alloy shows a lower corrosion resistance than those CMed samples, because SLMed samples consist only martensite phase, which is a meta-stable phase. Heat treatment can be used to eliminate these unfavorable characteristics of the SLMed alloys by means of microstructural controlling.

The goal of our research is to find suitable parameters for the beta annealing heat treatment to improve the corrosion resistance of the SLMed Ti-6Al-4V samples subjected to beta annealing heat treatment with various parameters. The microstructure of SLMed samples will be examined using an optical microscope and an X-ray diffract. Mechanical properties of the samples have been analyzed using Vickers hardness measurement, and tensile testing. The corrosion behavior of the samples will be examined by open circuit potential and potentio dynamics scanning in a 3,5 % NaCl solution using 3 electrode corrosion testing.

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DEVELOPMENT OF TANK VALVE FOR WATER TREATMENT DEVICE

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ABSTRACT

Tanks are used to store clean water in water purification devices used around the world. As the working principle of the tank; It is divided into two parts, which are compressed air at the bottom and clean water storage at the top. With the compressed air at the bottom, the clean water in the tank comes out under pressure. In case of filter change or malfunction in the water treatment device, it is done by closing the valve on the tank. Tank valve and water tank are supplied from abroad by the same company. Cracks occur in the tank valves during installation or at the customer's house, which causes water leaks and customer complaints. At the same time, since the hose is screwed to the tank valve, it increases the production time. For this reason, tank valve designs have been developed. Concept tracking and concept scoring matrices were applied to the developed designs. These developed designs are designed in such a way that the hose connection can be easily disassembled and mounted. The design prototypes selected from the developed designs were produced and the tank assembly control and tests were carried out.

DEVELOPMENT OF AIR PURIFICATION DEVICE WITH UV-C

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ABSTRACT

People want their home and office environment to be clean. However, invisible particles, viruses and organisms such as bacteria enter through the windows we open to clean the air. Air cleaning devices are used to clean the particles from the environment. Due to the recent pandemic, interest in air sterilization devices has increased. However, air sterilization devices only kill harmful organisms such as bacteria, viruses and spores in the environment and have no effect on particles in the air. For this reason, a device design that provides both air sterilization and air purification has been developed. In this developed device, it will be possible to kill bacteria and viruses in the air with a UV-C lamp. Air cleaning will be provided with HEPA filters positioned at the air inlet of the device. Then, with the carbon filter positioned at the air outlet part, the bad odors in the air will be removed. At the same time, ambient air quality is increased by giving negative ions at the air outlet of the device. Prototypes of plastic parts of our device, whose design was developed for both office and home, were produced and ready-made components were supplied. Covid-19 test and bacteria tests were carried out in accredited institutions on the sample production product.

RISK ANALYSIS IN ISTANBUL AND IIS DISTRICTS WITH FINE-KINNEY METHOD

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ABSTRACT

Earthquakes have adversely affected human life from past to present. The ever-increasing population and the increase in the buildings being built increase the risk of earthquakes. After 1950, Istanbul's population increased a lot due to immigration from rural areas. Istanbul, with a population of 15.84 million in 2021, according to the TUIK Address Based Population Registration system, is the most populous city in Turkey. The fact that the population is so crowded also shows how high the risk is in a possible earthquake. In this study, earthquakes greater than Mw ≥ 4.0 in and around Istanbul between the years 1900-2020 were examined and the districts that could be most damaged in the earthquakes that might occur were determined by Fine Kinney risk analysis method.

MACHINE LEARNING AND DATA MINING IN HUMAN RESOURCE MANAGEMENT: AN APPLICATION IN THE AUTOMOTIVE INDUSTRY

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ABSTRACT

The use of information systems in the field of human resource management (HRM) is gaining popularity as a result of global technological development. Today's workplaces have undergone a significant transformation that requires the use of human resources information systems (HRIS) in the implementation of human resources (HR) practices. The human resource knowledge management field includes rules, patterns, and relationships between data mining and machine learning data analytics and knowledge discovery. Data mining and machine learning are very important and both are used by businesses to turn datasets into useful information. It helps businesses analyze and understand trends that can lead to better business decisions. In the use of data mining, one can choose the right algorithms, set parameters, and model models for a particular problem. requires an expert who can train, and these are expert machine learning tools. In this study, research was conducted with employees working in a company operating in the automotive sector in Bursa, Turkey, between 01 April 2022 and 15 May 2022. Statistical and data mining techniques were applied to reveal the factors related to human resources management by using the obtained data IBM SPSS 25.0, IBM SPSS Modeler and Knime programs. The results of the human resources information system were evaluated and suggestions were made for future planning.

Acknowledgements: The research was carried out in an enterprise and has not been published anywhere before.

Ag POWDER REINFORCED PLA BASED BIOCOMPOSITE FILAMENT MANUFACTURING AND CHARACTERIZATION

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ABSTRACT

In recent years, great progress has been made in additive manufacturing technologies and the variety of application areas has increased. Fused deposition (FDM) modelling, which is an additive manufacturing technology, is preferred for various industrial applications due to its many advantages such as manufacturing speed, manufacturing precision and low unit manufacturing cost per piece in the manufacturing of complex shaped structures that are difficult to manufacture with traditional manufacturing methods. The use of PLA polymers has a large share in the manufacturing of filaments used for FDM technology. Various reinforcement studies are carried out to increase the usage areas of the filaments produced from this material. In this study, the manufacturing and characterization studies of PLA-based biocomposite filaments reinforced with 3 μm Ag powders, which are known to exhibit antibacterial character, at different weight ratios, were carried out for use in the health industry. To the test specimens obtained from the filaments produced; compression tests, DSC analyzes, MFI tests, SEM analyzes, XRD analyzes and antibacterial activity tests were performed. In the study, the effects of the increase in the weight reinforcement ratio on the characteristic properties of biocomposite filaments were investigated.

Keywords: Additive Manufacturing, Biocomposite, Filament, Silver, PLA.

CONTINUOUS GRANULE FEED 3D PRINTER

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ABSTRACT

In parallel with the rapid development of the manufacturing sector, the additive manufacturing method is also developing rapidly. FDM type printers are the most common in 3D printer technology and filaments are used in this method. However, filaments are difficult and costly to produce. Eliminating the use of filaments will reduce costs and reduce foreign dependency. Therefore, in this study, a printer that prints using granules instead of filaments has been designed and manufactured. The developed 3D printer consists of 3 parts. The first of these consists of the automation system that provides x, y, z axis movements, the second helical horizontal granule feeding unit and the third vertical screw extruder head. The granules in the granule feeding tank are conveyed to the melting barrel by passing through the helical horizontal feeding unit, and the granules are pushed to the first region of the bucket by means of the screw shaft located there, they are heated to 190 °C and after they are brought to a paste consistency, they are pushed to the polymer printing nozzle to reach 200-220 °C and then print. In the first sample studies, printing was carried out using 0.4, 0.6 and 1.00 mm nozzle diameters.

Keywords: 3D Printer, granule feeding, PLA, extruder.

CO-CULTURE BIOPRINTING OF TISSUE-ENGINEERED BONE-PERIOSTEUM BIPHASIC COMPLEX TO REPAIR CRITICAL-SIZED SKULL DEFECTS IN RABBITS

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ABSTRACT

Tissue engineering based on bioprinting technology has broad prospects in the treatment of critical-sized bone defect, but the challenge is to construct composite tissues/organs with structural integrity. Periosteum and stem cells play a key role in bone regeneration, and studies have successfully repaired bone defects using co-culture engineering system. Here, a strategy of co-culture bioprinting was proposed, and a tissue-engineered bone-periosteum biphasic complex was designed. Poly-L-lactic acid/hydroxyapatite (PLLA/HA) was used to construct the supporting scaffold of bone phase, Gelatin methacryl (GelMA) loaded with bone mesenchymal stem cells (BMSCs) and periosteum-derived stem cells (PDSCs) of rabbit were used to simulate the extracellular matrix and cellular components of bone and periosteum respectively, and a co-culture layer was formed between the bone and periosteum phase. By adjusting material ratios of PLLA/HA and crosslinking time of GelMA, a complex with good mechanical strength and cell activity was constructed and implanted into the defect area of rabbit skull, and the results demonstrated that the bone-periosteum biphasic complex had advantages both in bone regeneration and osteointegration. Overall, the co-culture bioprinting method is an effective strategy for tissue engineering, and expected to construct more complex tissues and solid organs.

USING ADDITIVE MANUFACTURING TECHNOLOGY TO PRODUCE CLEAR ALIGNERS

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ABSTRACT

Aim: Additive Manufacturing (AM) is a specific 3D printing process that builds objects by adding material in a layer-by-layer form according to digital 3D design data and very suitable for low volume production of parts with very complex shapes. The aim of this presentation is to present successful treatment with clear aligners (CA) made entirely in Slovenija.

Material and Methods: In this presentation 14 subjects with mean age of 32.7 years, treated with CA, were evaluated. Before treatment all subjects have a Class I molar relationship and positive overbite and overjet, mild crowded teeth, lack of crossbite, without visible asymmetry and with good facial proportions. The treatment began with a three-dimensional scan of the patient's study cast and occlusion by an optical 3D scanner. Software package was produced a 3D virtual model followed by a treatment simulation using the software for orthodontic planning and design of teeth models in normal occlusion. CA were made from a thermoplastic polyurethane (TPU) foil thermoforming it over the model made by laser sintering (SLS). The treatment success and subjects' satisfaction were analyzed.

Results: In all fourteen subjects treated with CA treatment was successfully completed and 12 (85.7%) of them were very satisfied and 2 (14.3%) satisfied with result of the treatment. Conclusion: The results support the choice of using CA in subjects with mild teeth crowding. Comparable to traditional fixed appliance (often made of metal) CA is a removable technique that can provide improved aesthetics, enables better oral hygiene and reduced chair time. CA have become a treatment of choice for aesthetically concered subjects who do not want fixed appliance treatment. The results show a great potential and future perspectives of AM in orthodontic treatment.

AUTONOMOUS LINE SUSPENDED POWER TRANSMISSION LINES INSPECTION ROBOTS

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ABSTRACT

Today, electrical energy has become an indispensable element in almost every area of life. The maintenance and inspection of power transmission lines that carry electrical energy from production points to demand points is very important. Maintenance and inspection of power transmission lines are done by two traditional methods, either by workers or by helicopter. As an alternative to these methods, energy transmission line inspection robots, which are more economical, fast and safe, have come to the fore. In the literature, inspection robots have been presented in various geometries, with various capabilities, and with various control methods. Among the robots in the presented studies, there are those that can be controlled by autonomous, semi-autonomous or remote-control methods. In this study, a review of autonomously controllable suspended power transmission line inspection robots will be presented.

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