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Scientific Tracks & Abstracts
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3D printed heart models in pediatric cardiology

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Objectives: To print 3D models of children hearts affected with complex congenital heart defects. To assess the accuracy of 3D printing by comparison of printed heart models with in vivo findings described by surgeons. To investigate the ideal form of printing in different types of congenital heart defects and to analyse the potential benefits of printed heart models use in surgical planning in pediatric cardiology.

Methods: Between December 2014 and March 2017, we printed 20 heart models for patients with congenital hearts defects. Initial data of heart anatomy came from CT images. A Bland-Altman analysis was used to evaluate the accuracy of 3D printing by comparing of cardiovascular proportions between models and in vivo surgical findings. The contribution of 3D printed heart models use for surgical planning improvement was analysed in all 20 patients.

Results: We successfully printed heart models in all 20 patients. The Bland-Altman analysis confirmed high accuracy of 3D heart printing. We printed the “cast types” of models, representing the “real” lumens of cardiovascular lumens, in 16 patients. The “meat-like types” of models, representing the “real” walls of cardiac chambers, were printed in specific demand to image the real size of defects in ventricular septum, in 4 patients. All heart models provided us valuable preoperative information of congenital heart defects 3D anatomy.

Conclusions: 3D printers can be effectively used for exact printing of heart models of children suffering from complex congenital heart defects. Different types of models can be printed depending on indication. The use of printed heart models have a potential to improve preoperative planning in these patients.

Speaker Biography

Peter Olejnik MD, PhD is clinical deputy chief of Pediatric Cardiology Clinic of Comenius University Medical School in Bratislava. He trained in pediatrics at the Slovak Medical University of Bratislava and pediatric cardiology at the Comenius University of Bratislava, where he also obtained academic title “PhD”. He has been practicing since 2004, all 13 years in Bratislava, Slovakia, at the Department of Pediatric Cardiology of National Institute of Cardiovascular Diseases of Slovak Republic. His practise specializes in the care of children with congenital heart defects and interests include modern imaging methods in pediatric cardiology, I.e. computed tomography imaging and magnetic resonance imaging. He is focused on 3D printed heart models for children suffering with complex congenital heart defects.

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Neurosurgical simulations using 3D models with soft blood vessels

Toshihiro Mashiko
Jichi Medical University, Japan

Three-dimensional (3D) printing has been a widespread technique across various fields of the business world. For medical use, 3D printed products are mainly used for surgical simulations. For example, prior to a plastic surgery for craniofacial deformity, surgeons create a skull model, dissect it, and try to collate the parts into their appropriate positions. In the present session, I will describe my experience of surgical simulations using 3D models in neurosurgery.

Several types of 3D models have been produced. I will predominantly focus on one of these models, a silicone model of cerebral aneurysm. Because of the propensity of cerebral aneurysm to rupture, it is a critical disease causing Subarachnoid Hemorrhage. We treat this disease by clipping surgery or by coiling intervention of the aneurysm. However, this surgery is challenging because the anatomical structure around these aneurysms is complicated and patient-specific.

Therefore, pre-surgical simulations are important. We decided that 3D printers might be useful for such simulations and developed 3D hollow elastic aneurysm models. A 3D printer, "UP Plus" (Beijing Tiertime Technology, China), with acrylonitrile–butadiene–styrene (ABS) as a modelling material, was used to produce a vessel model. The prototype was then coated with liquid silicone. After the silicone was hardened, the ABS was melted using solvent and removed, leaving the outer layer as a hollow elastic model.

Simulations using this hollow elastic model were performed in over 50 patients. In most patients, the clipping proceeded as scheduled. The postoperative assessment performed by surgeons showed favourable outcomes in most cases. This method allows simple fabrication at a low cost.

We also fabricate soft brain models using 3D printing and casting techniques. In these cases, direct products of the 3D printer, such as hollow elastic blood vessel and soft brain models are combined. These models are also useful; however, we had to spend time and effort on fabrication. I wish that 3D printers would automatically fabricate such types of models.

Speaker Biography

Toshihiro Mashiko PhD is Associate Professor in Department of Neurosurgery, Jichi Medical University, Japan. He is a member of many reputed Neuroscience Societies and published good number of research papers in Peer review Journals.

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FDM print parameter optimization to improve PLA parts mechanical properties

Noha Peter & Nancy Jean Ruzycki
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Rapid prototyping machines have advanced in recent years, such that typical FDM (Fused Deposition Modelling) desktop printers can be used to manufacture functional parts for industrial use. One major issue preventing widespread use of FDM printers is the lack of consistency in parts quality. The quality of the material being used, and the print conditions or parameters of the printing process can cause changes to the mechanical properties of the printed parts and subsequently calls into question the reproducibility of parts. This paper seeks to factorize printing parameter effects for additive manufacturing of parts, the effect of the material quality on the mechanical properties of the printed parts, and possible optimization routes for printing parameters. The material selected for study is PLA (Poly Lactic Acid), an increasingly utilized bioplastic polymer owing to its biocompatibility, degradability, and sustainability. Using a design of experiments (DOE) approach, the print parameters of FDM printer, raster orientation and layer thickness were systematically varied to determine effect on mechanical properties. Thermal analysis using Differential Scanning Calorimetry (DSC) was performed on the filament before printing at different points in the spool, and of the printed parts after printing to study crystallinity and structural changes produced by the printing process, and to quantify material differences prior to printing. The results from the subsequent analysis will be used to optimize print parameters to ensure quality of the printed parts in terms of mechanical properties, by deducing a correlation between print parameters and mechanical properties of PLA and predicting reproducibility of parts in terms of mechanical properties.

Speaker Biography

Noha Peter is currently pursuing his Masters in Mechanical Engineering at the University of Florida. He is working as a research assistant in the field of additive manufacturing under the guidance of Dr Nancy J Ruzycki of Material Science and Engineering. He has worked for 3 years as an equipment engineer, engineering various kinds of rotating and packaged equipment for clients across the world.

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Evaluation of compressive and flexural properties of a fiber reinforced additive manufacturing technology as a design input for a novel foot-ankle device

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This research focused on the characterization of additive manufacturing technology based on composite filament fabrication (CFF) as a design input for a novel foot-ankle device. CFF utilizes a similar method of layer by layer printing as fused filament fabrication, but is also capable of reinforcing parts with layers of various continuous fibers into a polymer matrix. Due to the orthotropic characteristics of additive manufacturing based on fused filament fabrication, 3D printed parts may present different mechanical behaviour under different orientations of stress. Furthermore, technologies such as CFF allow a range of configurations to fabricate and reinforce the parts. In this study, mechanical characterization of polyamide 6 (PA6) reinforced with carbon fiber and fiberglass was conducted by design of experiment as a statistical method, to investigate the effect of reinforcement, print orientation and percentage of fiber on mechanical properties in compression and flexion. The results were considered as an input to design and validate a novel low-cost foot-ankle device by using CAD and CAE tools.

Speaker Biography

Miguel Araya-Calvo is currently working on a Master's degree thesis in Medical Device Engineering from the Instituto Tecnológico de Costa Rica, Costa Rica, related with a novel foot-ankle design implementing fiber-reinforced additive manufacturing technology. He is a researcher at the ergonomics and biomechanics laboratory and an Industrial Design Engineering professor at Instituto Tecnológico de Costa Rica. He has focused for more than 3 years on the implementation of 3D printing for low cost below-the-knee prosthetic solutions.

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Development of economic DLP and resin based 3D printing system for micro fabrication of fine resolution

Shweta Thapa
Rutgers School of Mechanical & Aerospace Engineering, USA

3D printing has revolutionized the world of manufacturing, education, food, jewellery and will no doubt be our next in house robot, making luxury a convenience for us. My deep rooted interests for 3D printing in biomedical sciences and its upgrades in the medical field inspired me to design an economic DLP cum resin 3D printer for fine resolution and precise micro fabrication. This printer finds great application in the medical industry and jewellery business.

The system is based on projection of micro stereo-lithography which involves additive layer by layer manufacturing of the 3D polymer on application of LED light from the projector. Existing DLP and resin printers cost manifolds and are not accessible to the common man. A printer that can solve problems of the mankind and is affordable at the same time is the subject matter of this technology. A compact and portable 3D printing system composed of a simple desktop and a 700 lumen light projector can be used to make microstructures and soft materials of the order of 50-300 microns. The study involves the development of the experimental setup, optical and material characterization of the system and product specimen testing on the shape memory polymer.

Speaker Biography

Shweta Thapa completed her MEng in Mechanical and Aerospace Engineering at Rutgers University. Her special interest in 3D printing grew during her project work in college as well as interning for 3D printing companies. She is the Founder of 3Ducators a non-profit organization for empowering communities using 3D printing. She has also worked in great mechanical industries like Atlas Copco and Trumpf Photonics. She is an esteemed member of National Association of Professional Women (NAPW).

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How the budding enterprises in medical service industry can plan for the entry into new evolving 3D print

Anwar Shariff
Spectra Labs co, Australia

I have 15 years of 3D design and detail engineering experience in power plant and Oil & Gas plant areas working as entrepreneur providing service for MNCs like GE Power, Siemens, Alstom, Lurgi, Kvaerner, Bechtel, Worley parsons, Ausenco, etc.

After this, I have moved into medical services starting a Medical Centre as owner and operator for last 5 years, employing Doctors and clinical staff for my clinic with general medicine OP, Allied health, Specialist services, Pathology collection services etc.

Now, I have setup a team and working on combining my 3D engineering experience and Medical service industry ownership and operations exposure to DEVELOP AND DELIVER the medical products like 3D printed, casts, braces, splints, dental prosthesis, semi-automated body Prosthetics, automated prosthetics etc., CUSTOMISED TO SPECIFIC PATIENT NEEDS.

The key item of my speaking can be about how the budding enterprises in medical service industry can plan for the entry into this new evolving 3D print practice for precision based medical products manufacturing and what parameters work well for product development in securing a place for the future competition and excel as the industry grows. Especially adding charm to the prosthetics and other medical products using color and fashion and individual character to supply CUSTOMISED products to SPECIFIC PATIENT NEEDS.

Speaker Biography

Anwar Shariff is an entrepreneur with 15 years of experience in providing engineering consultancy services for major MNCs such as GE Power, Siemens PG, Lurgi Gmbh, Alstom Power, Worley Parsons, Bechtel, Aker Kvaerner, etc., providing high value detail design and 3d Design services as Lead design coordinator in power plant & petro chemical plant designing. Also has major experience in designing of Turbines, Boilers & Pressure vessels. He owns and operates Design consultancy business in Australia since 2004 based in Brisbane. He is well aware of various aspects of running a good business.

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Emotional marketing for advanced 3D printing technologies

Rahul Anand
The Ideas Maker, USA

Since 2012, 3D Printing has moved beyond prototyping. Companies and individuals are continuously innovating in the space and we are moving beyond FDM and SLA Printing. We are moving towards gel printing and so much more. To sustain competitive advantage and create transformational value proposition for end users, companies need to create powerful, emotional and differentiable messages. These messages MUST align with the core of the 3D printing technology users. An analysis for cleansing the core with innovative thought leadership uses powerful models such as balanced scorecards, 5 forces analysis for industries, value chain analysis and growth share matrices. This paper also details on the innovative thought leadership technique applied to a startup 3D Printing company.

Speaker Biography

Rahul Anand after working with Google for over 2 years, he pursued his dream of strategic innovation and entrepreneurship by finding The Ideas Maker and building his own FDM 3D printer. His bio was published by Rutgers University where he was also awarded the Student Entrepreneur of Year 2016.

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Video Presentaions
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Perry E Jones

Virginia Commonwealth University, USA

Digital scanning and 3D printing: The future is now for dentistry

Patients no longer must endure the “goo”, “mess” and “gagging” of traditional impression taking! Fast, highly accurate, no “mess” intraoral digital scanning has evolved to vastly improve the world of both patient and dentist! Highly accurate digital data allows equally accurate 3D printed models to be created in the dental office for everyday use. Dentistry has left the “Stone Ages” of fragile, inaccurate, messy gypsum models! Computers are now used to trim 3D printed models rather than using “stone age” grinders. Specific purpose made polymers is used with in-office 3D printers to 3D print accurate 3D models, surgical guides and provisional restorations. Patients can now have teeth replaced with implants so accurate that the restorations can be premade and delivered at the time of implant placement. Patients can walk out with new implants and new teeth! A wide range of specific case examples will be presented.

Speaker Biography

Perry E Jones is a graduate of Virginia Commonwealth University, School of Dentistry, where he is an Adjunct Faculty, Associate Professor in the Oral Maxillofacial Surgery Department as well as an Associate Professor in the Department of General Dentistry. He has earned a Fellowship as well as Mastership in the Academy of General Dentistry and is the Director of the Virginia AGD Mastership program. For the past 10 consecutive years, he has given the Invisalign University Training program to the D3 pre-doctoral dental students at VCU School of Dentistry. He developed the curriculum for the VCU D2 Thermoplastics course, the first University in the world to use 3D printed models for a hands-on thermoplastics University course. Orthodontics has been a key practice focus for some 30+ years. One of the first Invisalign certified GP providers (2001), He has been a member of Align’s speaker TEAM since 2002, presenting some 300+ Invisalign certifications. He has published some 40+ articles in publications that include: Glidewell’s Inclusive Implant magazine, Chairside magazine, Dentistry Today, Inside Dentistry, Dental Product Shopper, Dental Economics, Journal of the Academy Cosmetic Dentistry, Journal of Clinical Orthodontics, Journal of Oral Implantology and others.

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3D digital colposcopy

Coppolillo Paez Enrique Fernando
University in Buenos Aires, Argentina

3D digital colposcopy is a method that uses a software to transform digital images 2D in 3D images. We have developed the software Scoper 3D, this software is easy to use and is possible with it, to distinguish details and characteristics of the epithelial tissue surface. You can change the viewing angles of the images, impossible to achieve with traditional colposcopy and improving the diagnostic possibilities. 3D colposcopy is very useful in telecolposcopy (virtual colposcopy)

Speaker Biography

Coppolillo Paez Enrique Fernando is PhD distinguished in medicine, researcher, gynaecology professor in Buenos Aires University, and honour professor of UNAM (Mexico). Former president of Argentina Society and Latin-Americans Federation of Lower Genital Tract Pathology and Colposcopy , member of American Society for Colposcopy and Cervical Pathology He has many nationals and international publications. He is the author of the book "The Colposcopy in the Digital Era "(in Spanish and Portuguese) author of chapters in colposcopy and cervical pathology books and editorial board member of Journals.

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Femto-second laser lithography of 2D and 3D nanostructures

Shobha Shukla
IIT Bombay, India

Next-gen technologies will rely heavily on ability to go in third or even fourth dimension. Additive manufacturing of 3D at large scale have been demonstrated extensively in the past but micron size or below has been elusive till date. Strong absorption of materials below infrared wavelength makes 3D patterning impossible using any standard lithography process. Femto-second laser working in IR range utilize simultaneous absorption of two photon for realizing 3D nanostructures.

Speaker Biography

Shobha Shukla is an Assistant Professor in the Department of Metallurgical Engineering and Materials Sciences at the Indian Institute of Technology, Bombay, India. She obtained her doctoral degree at the State University of New York/SUNY Buffalo, USA. Subsequently she worked as a postdoctoral fellow at the School of Engineering and Applied Sciences Harvard University, Cambridge, Massachusetts, USA.

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Wall clock design made with recycled materials

Tatjana Burzanovic
University of Donja Gorica, Montenegro

In accordance with the PRODE Project Activity Plan and within the exam Marketing in design (practical part), the students of the Faculty of Design and Multimedia, apart from the theory, had the task to create wall clock made with recycled materials. This activity required a high level of creativity and innovation in its implementation with minimal costs occurred.This task has been given with the intention to; besides to unique product for the market, activate the access to eco-sustainable and responsible design, as well as universal design for all.

Fashion design: Fast and inevitable process of globalization calls for the beginning of the development of this field of study in Montenegro as well, and with it the development of special and adequate professional training also. This is the main reason why the Faculty of Design and Multimedia in its program, which was created according to the needs of the modern consumer society, gave special importance to the fashion design. Studies of fashion design a tour faculty are based on practical and theoretical methods, which hallow the creation of future professionals-fashion designers.

Graphic and multimedia design: The term graphic and multimedia design can be found in almost all artistic and professional disciplines, with a special focus on visual communication and messages in the context of creating and placing symbols, characters, images, words, ideas or messages. Faculty of Design and Multimedia with its department Multimedia-graphic design completes a unit called “visual communication”, which is part of the context of the applied arts. Its justification is based on the need to define the visual problems in Montenegro. Graphic and multimedia design will be a combination of theory and practice, which will enable young people to do the work of designers.

Speaker Biography

Tatjana Burzanović, assistant professor PhD of fine arts-graphic design. Coordinator and lecturer at the Faculty of Design and Multimedia (teaches subjects Marketing in design and Portfolio), on University of Donja Gorica, Montenegro. Lecturer at the Faculty of Culture and Tourism, University of Donja Gorica (Indian Culture).

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