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ON-MACHINE CIS SOC-BASED LAYERWISE INSPECTION SYSTEM FOR MEX ADDITIVE MANUFACTURING

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Additive manufacturing processes build three-dimensional objects usually following a layer-upon-layer strategy. An interesting feature of this strategy is that each layer could be inspected before the next one is deposited. On-machine integration of layerwise inspection systems would not only allow for an early characterisation of the dimensional and geometric quality of the part, but also for the detection of intralayer defects. Contact image sensors (CIS), such as those used in desktop flatbed scanners, could be used for this purpose since they would provide bi-dimensional digital images of the whole layer and its neighbourhood. CIS images combine high reso-lutions with a reduced acquisition time. In this work, a material extrusion (MEX) additive manufacturing system, with layerwise inspection capabilities is proposed. The system has been equipped with the CIS that Epson uses in its Perfection V39 flatbed scanner. The sensor provides two analogue output signals, each one consisting on 2584 voltage levels, that represent the amount of light reflected by the material. This analogue information is sent to a parallel AD converter, where an 8-bit encoding is assigned to each one of the pixels on the digitised image. To overcome microcontroller-related problems, a Zynq®-7000 system-on-chip (SoC) has been used. This SoC integrates an ARM® based processor, with the hardware programming of a field programmable gate array (FPGA). This architecture ensures an accurate and controlled readout of the various AD converters. The resultant digital image of each layer could then be then processed using different algorithms to detect defects, extract the geometry of the layer contour and characterise the dimensional and geometric quality of the object.

Keywords: Additive Manufacturing, Layerwise Inspection, Quality

USING PETG/RPET BLENDS IN FUSED PARTICLE FABRICATION: ANALYSIS OF FEASIBILITY AND MECHANICAL BEHAVIOUR

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Additive manufacturing production of plastic parts has experienced a continuous increase during the past decades. Simultaneously, advanced societies have become deeply concerned about the use of plastics and their impact on natural environments. As a result, there is a growing interest in recycled plastic as a feedstock material in additive manufacturing machines. However, the commercialization of recycled plastic filament introduces additional production and distribution steps. An alternative approach would avoid these steps by mixing recycled particles (obtained from local waste) with brand-new particles and using the resultant blend with Fused Particle Fabrication (FPF) machines. Present work analyses the feasibility of extruding blends composed of Pol-yethylene Terephthalate Glycol (PETG) spherical pellets and recycled Polyethylene Terephthalate (rPET) flakes. The rPET flakes were obtained from wasted water bottles collected and processed locally. Then, tensile and flexural specimens were manufactured for combinations of different rPET particle sizes and PETG/rPET blends (100%PETG, 30%rPET/70%PETG, 50%rPET/50%PETG, and 70%rPET/30%PETG). The experimental plan included relaxation tests for calculating the ratio of viscoelasticity and tensile tests for calculating the stiffness of the material and the ultimate mechanical strength. From the results, it has been inferred that an increase in the percentage of rPET causes an increase in the relaxation Young modulus of the test specimen. It has also been found that the viscoelasticity ratio remains nearly constant among the different blends. On the other hand, the tensile tests showed an increase in the stiffness behaviour related to the presence of rPET, which would be in agreement with the results obtained in the relaxation test. Moreover, a relationship between a significant increase in the ultimate mechanical strength and the percentage of rPET has also been found. Particle size has not been found to have a clear influence on the results.

Keywords: Additive Manufacturing, Recycled PET, Mechanical Properties

GENERATION AND CHARACTERIZATION METROLOGY OF TEXTURES FOR DESIGN OF STREET FURNITURE WITH RECYCLED MATERIAL. A CASE OF STUDY FOR ADDITIVE MANUFACTURING

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The urban furniture design process in modern settings has not only functional implications, since there is a direct link with the environmental, visual and sound impact. All of this is also related to people's quality of life. So, the search for sustainability through materials and processes as well as the assessment of user perception. On the other hand, both materials and geometries must be suitable for acoustics [1]. In the context of recycled materials, one of the branches of research focuses on the search for applications such as urban furniture. In turn, 3D printing technology makes it possible to make personalized products and use recycled materials. The research focuses on the creation of organic textures for the creation of urban furniture printed with recycled materials. It is intended to make an analysis of the state of the art in this field and to propose a series of textures and reliefs based on organic forms, their manufacture by means of additive manufacturing of molten material (FFF) and their metrological study of the pieces manufactured with respect to the models created. by computer aided design.

[1] G. Fusaro, F. D'alessandro, G. Baldinelli, and J. Kang, "Design of urban furniture to enhance the soundscape: A case study," Build. Acoust., vol. 25, no. 1, pp. 61–75, 2018, doi: 10.1177/1351010X18757413.

Keywords: Product Design, Addtive Manufacturing, Texture, Street Furniture

RECIPE TO STRENGTHEN CONTINUOUS FIBER REINFORCED 3D PRINTED PARTS.

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Today, the design of polymer parts by additive manufacturing subjected to large stress has undergone a clear advance with the new concept of continuous fiber-reinforced thermoplastic composites (CFRTPC). The optimization of fiber alignment is the main asset to improve strength and has been widely discussed by the research community. In this work, the effect of the intercalation of the polymeric matrix (ONYX) between layers of continuous fiberglass reinforcement has been analyzed in tensile and shear specimens. Onyx is nylon mixed with short carbon fibers. The results show how inserting polymeric layers among the continuous fiber ones improves the shear strength and the stiffness modulus. Furthermore, the ONYX layers insertion positively impacts the shear samples, while the stress samples show no apparent improvement.

Keywords: 3D Printing, Fiber Reinforcement, Shear Strength, Intercalation Of Matrix Polymer.