Survey paper on different techniques additive manufacturing

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ABSTRACT

Scientists and engineers impress us daily with revolutionary technologies that turned what was recently considered as science fiction or inconceivable futuristic into reality, making their lives much easier and more interesting. For example have you ever imagined being able to make your own designed glasses frame, kid's toys, or any other prototypes at your home using raw materials and a single machine? The 3D printing technology enables you to do this and it has much more complicated applications in science and industry. This is survey paper in which the introduced to the 3D printing technology, its definition, history, basic components, and operation theory. The applications of commercialized metal 3-D printers are limited to only rapid prototyping and expensive finished products. This severely restricts the access of the technology for small and medium enterprises, the developing world and for use in laboratories.

Keyword: - *3D Printing etc….*

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1. INTRODUCTION

Conventional manufacturing is widely being used in current scenario but recently researchers and people from industry have done a lot of research and applied 3-D Printing using metals in practical applications like in the aviation industry, medical and arts. This paper is based on comparison of these two manufacturing techniques, conventional manufacturing using 4-axis CNC machine and 3-D Printing using RENISHAW AM 400; furthermore the comparison is from the manufacturing point of view only. Points of comparison consist of Lead time requirement for manufacturing, Electricity requirement for the manufacturing of same component, Total energy consumed in manufacturing of the component, steps involved in manufacturing of the same also effect of these two techniques on the environment in the form of carbon emission is presented in this study, complexity these two techniques that can handle and Mechanical testing is also added. Finite element analysis (Static) is conducted on both the parts and results.

Additive manufacturing is also known as 3D printing, the rapid prototyping or the free form fabrication, is the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposite to subtractive manufacturing methodologies' such as machining. The usage of Additive Manufacturing (AM) with metal powders is a novel and rising industry sector with many of its leading companies based in Europe. It became a appropriate process to produce complex metal net shape parts, and not only prototypes, as before. Additive industrial now permits both a design and industrial uprising, in various manufacturing sectors such as aerospace, energy, automotive, medical, tooling and consumer goods.

2. LITERATURE SURVEY

2.1 Additive Manufacturing, Cloud-Based 3D Printing and Associated Services –Overview:

Cloud Manufacturing (CM) is the concept of using manufacturing resources in a service-oriented way over the Internet. Recent developments in Additive Manufacturing (AM) are creation it possible to apply resources ad-hoc as replacements for outdated manufacturing resources in case of spontaneous problems in the established manufacturing processes. In order to be of use in these scenarios, the AM resources must adhere to a strict principle of transparency and service composition in adherence to the Cloud Computing (CC) paradigm.

The first part of this review is the analysis of other reviews in order to establish a foundation of the existing works and to have a baseline for the analysis of the literature in this area. This review identified its sources by a web search for each of the identified topics depicted in the concept map, where the first 30 results from the search engines are each scanned first by title, then by their abstract. For the creation of the topological map, an iterative process is applied. The process starts with the analysis of the following works, which we had prior knowledge of, due to previous engagements in this research area. After the analysis, a backward and forward search is performed. The searches for the content of the review are sorted by relevance, according to the search engine operator. The articles are then analyzed and their core concepts are presented in this work. For the review, first the titles were checked for applicability to the area of interest. Research that could clearly be identified as out of scope by the title was discarded. The remaining works were divided amongst the authors for analysis of their abstracts. A classification into the topics was performed and discussed amongst the authors. Works that were identified as out of scope based on the analysis of the abstract were also discarded. The remaining literature was consecutively analyzed by the authors. Consensus on the abstraction was achieved via discussion. The reviews for the meta-review are identified by a web search and data gathered during their review. To compile the definitions, an extraction process is employed where the identified literature for the review is the basis for information extraction and dissemination. The compilation is expanded by literature and Internet research for the appropriate keywords and concepts.[1]

2.2 AM 400 additive manufacturing system:

The Renishaw AM 400 is the latest development of the Renishaw AM platform. It features all the most recent pluspac machine updates with larger safe change filter, better optical control software, revised gas flow and window protection system and a new 400W visual system to give a condensed beam diameter of 70 µm, in line with the current AM 250 200 W stage. The advantage offered by the AM 400 is the option to develop parameters that deliver higher output through faster scan speeds, whilst still maintaining feature definition and precision. An extra advantage is the straight transferability of existing 200 W material case parameters from the AM 250 200 W system. The increased laser power of 400 W attentive at 70 µm also provides the potential to process materials with elevated melting temperatures, with a significant rise in energy thickness likened to the current AM 250 400W systems.

2.2.1 Flexible material usage-

The AM 400 features an outside powder hopper with valve interlocks to allow additional material to be added whilst the process is running. It is possible to remove the hopper for cleaning or to exchange with a secondary hopper for materials change, so multiple material types can be interchanged with relative ease. The powder overflow vessels are outside the chamber and have isolation valves. This allows unused materials to be sieved and reintroduced to the process via the hopper while the system is running.

Software The Renishaw quantam file planning software has been developed by knowledgeable team of software engineers specifically for use with Renishaw additive manufacturing systems. Quantam is designed to be simple to learn and intuitive to use and is an ideal product for new users.[2]

2.3 Integrated Voltage—Current Monitoring and Control of Gas Metal Arc Weld Magnetic Ball-Jointed Open Source 3-D Printer:

To provide process optimization of metal fabricating self-replicating rapid prototype 3-D printers requires a low-cost sensor and data logger system to measure current (I) and voltage (V) of the gas metal arc welders (GMAW). This paper figures on preceding open-source hardware development to deliver a real-time measurement of welder I-V where the measuring circuit is connected to two analog inputs of the Adriano that is used to control the 3-D printer itself. Franklin firmware accessed over a web frame that is used to resistor the printer allows storing the restrained values and transferring those stored readings to the user's computer.

This paper has provided the new design for an integrated mechanically improved delta-style GMAW 3-D printer with current and voltage measurement of welder without adding an extra controller. The better mechanical design augmented the build radius by 10 cm and better print quality. In addition, by connecting the IV measuring board back to the RAMPS board that is controlling the printer, the measurement can be recorded in real-time through the RAMPS board. These new design assistances reduce the cost and the difficulty of hardware. The measurement provides the up-to-date and voltage feature for each type of alloy through welding. The alloys were successfully monitored and had measurements consistent with their electrical resistivity. The ability to video display unit the voltage and current of GMAW offers more data connected to the energy input for exhibiting and printing procedure and property optimization.

2.3.1 Algorithm

From the recorded data file, the timestamp in the first column is in a negative millisecond format which is not intuitive. To convert the negative millisecond to the positive second can be done using Equation where is the number of lines in the input data file.

There can be two types of noise in the data: zero-noise and non-zero-noise. Zero-noise is the zero values that happen during the layer that need to be replaced with a very minor value so the layer algorithm does not misunderstand them as the layer parting points. Non-zero-noise is non-zero values that occur between the layers that need to be replaced by 0. After that data is separated into layers of non-zero data by the following concept. First, the logical operator "not equal" is used to find non-zero data. Then the "diff" function is used to find the difference between the current cell and the previous cell in each row of the result from the previous step. Lastly, the start index and the finish index of each layer are initiate using "find" function which discovery the optimistic value for the start index and the negative value for the end index.

The two standard error of each layer is calculated in Equations where is the data, the mean or the average of the data layer length, and the standard deviation. The average voltage and current for each layer were calculated on a per alloy basis.[3]

2.4 A SCULPTEO GUIDE TO COST EFFICIENCY THROUGH SHORT SERIES MANUFACTURING: 3D PRINTING VS INJECTION MODELLING:

Ordering multiple objects directly on their website turns 3D printing into a real manufacturing solution. By creation it cost active for people to order advanced dimensions, Sculpteo is taking 3D printing beyond prototypes and on-demand built-up and into mass-production.

To determine the estimated 3D printing production cost for each of the five parts, a 3D model was uploaded to the Sculpteo website. Algorithms check the part for 3D printability, focusing on design errors that may cause 3D prints to fail. Specifically, Sculpteo conducts a "Solidity Check" which confirms that all features on the part are above the minimum feature size threshold of approximately 1 mm. Next, using the "Batch Control" feature for Discerning Laser Sintering, Sculpteo calculates a cost per unit as well as a total batch cost. Batch control is automatically enabled once an order of 20 or more parts is selected, and helps to optimize unit price by generating a dedicated production run. Greater control over the production run is enabled, including orientation, layer thickness, and finish quality to optimize part cost to best suit the individual application. The options selected for the five part case studies were white plastic (Nylon PA12) raw finish (sand blasted) with a standard layer thickness (100 micrometers). The injection molding production costs were estimated by requesting quotes from companies that offer rapid injection molding services. The companies analyze the 3D model for manufacturability, looking at design elements such as part orientation and parting line, draft, thickness, warp analysis, and more. Once the part is manufacture ready, quotes were generated for assembly via the "rapid injection molding" method. This method is used for prototypes and short series manufacturing, typically limited to 10,000 units. However, this process does not enable the manufacture of parts with a hollow interior. For parts holding a hollow interior, a secondary engineering method called "gas assisted injection molding" was used. The table below summarizes which companies were used to generate the production cost data, as well as the part material, and the method of injection molding.

Quoted By Material IM Method Cockerel Protomold Polypropylene (PP) Rapid Go-Pro Handle Quickpart Polypropylene (PP) Rapid Remote Control Case Quickpart ABS Rapid Car Handle Sinomould Polypropylene (PP) Gas Assisted Sprocket Protomold Nylon 6 Rapid.

The results for the collected data are summarized in the charts below. Each chart depicts the cost of the injection molded part per unit versus the cost of the 3D printed part per unit. The injection molding datasets comprises startup budgets such as the cost of tooling. The intersection of the two lines defines the number of manufactured units where 3D printing and injection molding per unit cost overlaps; in other words, the intersection represents the upper limit of the number of 3D printed units where 3D printing remains viable as a manufacturing method.

3. CONCLUSION

We can conclude that, 3D printing is no more expensive, it is spreading widely in a variety of applications, from simple domestic use to complicated industrial applications with decreasing cost and increasing efficiency. Some experts argue that these printers will be the drive of a coming revolution that will change the whole face of industry, and that it will be a basic part of every home in accordance with the decrease in cost.

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