

The effect of finite element analysis programs on the quality of infill design of the 3D printed model

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Abstract:

3d printing is a process that leads to the manufacture of 3d models directly using layer-by-layer raw materials in various directions depending on the printing technology used through the design file of the 3D model without the use of additional equipment and at a lower cost than the traditional manufacturing method. FDM is one of the best, most popular and affordable 3D printing technology on the market. It is a great choice for fast, low-cost prototypes that can be used for a variety of applications and can also be a suitable solution for functional models.

Printed models can be designed so that don't need to be combined together using complicated engineering and then lower cost that improves the mechanical properties of printed models such as strength and hardness, which leads to improved performance of the functional model with the possibility of reducing the use of raw materials.

Defining the basic standards elements in the design such as (supports, bridging, infill and wall thickness) is an important tool for the successful design of the 3D printed model, and these elements lie in durability, ergonomics, dynamic stability and longevity, even storage conditions. All these elements affect the quality of the 3D printed model.

Then this study aims to analyze and achieve the strengths and weaknesses and the extent of the impact of applying international standards for infill design when preparing the design file on the quality of the printed product. To achieve quality in the printed model, the results attained from finite elements analysis (FEA) to influence the design of the internal structure by locally varying the composition of the infill based upon the associated stress values by using Autodesk Fusion 360 program to simulating the model on the program and then printing the model before and after the improvement and testing it under pressure conditions of up to 85 kg.

Keywords:

3d printing, Fused deposition modelling (FDM), Infill, Finite element analysis (FEA)