DURABILITY AND DAMAGE TOLERANCE OF ADDITIVE MANUFACTURING POLYMER PARTS FOR AEROSPACE APPLICATION

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Abstract:

This study aims to assess the fatigue performance of additive manufacturing (AM) parts for aerospace application. This will lead to improve AM part designs. A computer aided design (CAD) program is used to design groups of "dog bone" specimens based on ASTM Standards for Polymer Tensile Testing ASTM D 638-10. These specimens are made from a commercial Polymer, acrylonitrile-butadiene-styrene (ABS) P430. The specimens are manufactured in different orientations using a Stratasys BST 1200es fused deposition machine. Also, the purpose of this research is to investigate material behaviour under different fatigue loading conditions. It is essential to understand the mechanics underlying the failure process to ensure high quality AM end products. Fatigue analysis was conducted and both fatigue initiation and propagation were investigated using low K_t specimens. However, the focus will be on crack initiation. The specimens are tested under low cycle fatigue loading. This study will also identify which fatigue test methods are suitable for polymer and metallic AM components. The influences of design parameters such as building orientation and the layer thickness on fatigue life will be presented.