CREEP MODELING OF 3D PRINTED IN 718 SUPERALLOYS

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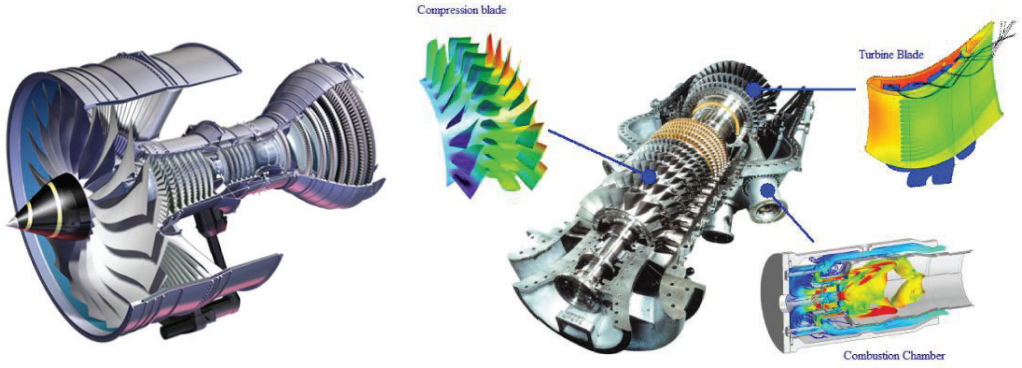
ABSTRACT

Creep properties are critical for metals used in high temperature environment. This work aims on developing a finite element-based model for modeling the creep behaviors of a 3D printed nickel based super alloy Inconel718. Based on the existing laws in ANSYS, a creep behavior is simulated for IN718 superalloy and the primary and secondary regime are studied. Additionally, a microstructure-based creep prediction model is formulated to generate a response of strain over a period for the given material and specified operating temperature.

INTRODUCTION

To better understand the complexity of mechanical systems with the cost of conducting experiments increasing, Finite element analysis (FEA) software are being utilized more frequently in the engineering industry. Components at high temperature applications which are subjected to high stress are expected to last for years. The interaction between the physical processes is challenging to determine and for such situations Finite Element simulations are important to estimate rupture lives of such components. Industrial gas turbine (IGTs) push their components to the very limit of their thermal capacity leading to failures due to vibration, fatigue, foreign object damage, corrosion, erosion, embrittlement, and creep. [1] To design such turbines with greater thermal performance has led to the need of developing models that encompass all the three stages of creep.



(a) (b)

Figure 1: Representative (a) IGTs (Industrial Gas Turbines) and (b) Components subjected to failure.[1]