

Survey on Thermal Stress and Fatigue Analysis Techniques in Jet Engine Components

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Abstract: In essence, jet engines are propulsion engines that compress incoming air to high pressure before allowing it to combine with fuel. This allows combustion to occur in the combustion chamber because of the high temperature. This review gives an in-depth overview of the jet engines' performance and reliability problems, namely their structural behaviour, thermal loading, and fatigue mechanisms. The key components and working systems of the engine are shown together with their monitoring devices and controls for power setting. The study is centred on high-temperature gas thermal stresses, pressure and inertia forces as mechanical loads, as well as their joint effects of temperature and mechanics on the distribution of deformation and stress. Finite-element method applied to the pistons exposed to thermal, mechanical, and coupled loads points out the areas that are most vulnerable to failure. The review also covers the fatigue phenomena, namely, stress-life and strain-life characteristics, vibration-induced stress cycles, and creep-fatigue at high temperatures. To summarize, the author points out as the major advantage of the article the necessity of accurate load forecasting and the advancement in diagnosis methods concerning motor lifespan and safety.

Keywords: Jet Engines, Thermal Stress, Mechanical Load, Fatigue Analysis, Structural Integrity