



Implications of Flange Coupling in Gas Turbine Engine

Maryam Jae*

Department of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, China

DESCRIPTION

The rotating turbine shaft energy is utilized to drive compressor and other devices like an electric generator. The energy that is not used for shaft work comes out in the form of exhaust gases, these have either higher temperature or higher velocity. The purpose of gas turbine determines most desirable form of energy which is maximized, so gas turbines can be used in aircrafts, trains, ships, electrical generators or even in tankers. Due to critical role played by the rotating components during operation of the gas turbine engines, flange couplings require special consideration and vigilant design. Reliability of these components are of prime concern, hence manufacturers are always keen to be on safer side of their product limitations. A typical jet engine cross-section demonstrating different stages of rotors and rotor couplings used in it. The axial-flow compressors are utilized in a very wide series of aero engines due to its light weight, small frontal area and simple flow path. It is a steady-flow device, which works on gas passing through it, raising pressure and increasing enthalpy. Generally, an axial flow compressor contains several "stages". Each stage consists of a rotor or disc, which is mounted on a central shaft, and rotates at high speed, together with a stator, which is fixed to the casing.

The rotor and the stator have aerodynamically profiled blades designed to generate a pressure difference across the stage. Attainable pressure rise per stage is restricted by aerodynamic efficiency of the blade and several stages are required for building up a beneficial pressure difference. Most components in a gas turbine engine are exposed to stresses and vibrations caused by unsteady forces due to relative motions of rotating and non-rotating parts. These vibrations in gas turbine stages are one of the most significant reasons for failures of blades or bladed

disc assembly in compressors and turbines, that have drawn a great deal of attention from researchers in the field of structural integrity for more than half a century. In blisk, the chances of the blade leaving disc due to huge centrifugal stress and rubbing its tip against casing are minimized. As the blade happens to be the integral part of the blisk, controlled tip clearances reduce recirculation at the tip, thereby reducing aerodynamic losses. The life of rotating structural components, such as the bladed disc, is directly related to accurate determination of dynamic characteristics and recognition of critical importance of these components. In a gas turbine engine, purpose of rotor shaft and disc assembly is to support and drive the rotor blades.

CONCLUSION

Military fighter aircraft requires engine with rapid acceleration and deceleration capabilities for maneuverability. It is necessary to have an engine with higher thrust to weight ratio. For military engines, the reduction of disc weight would not only increase overall engine thrust to weight ratio directly, but also has an impact on the weight of its associated supporting structures like shafts, bearings etc. In gas turbine compressors, two dominant factors, which adversely affect useful life of a structural associate, are stresses and temperature. During operation of gas turbine there is an alternative cycle of stress and strain due to the variation of gas temperature in engine and the blades. The loads acting in these applications give rise to high stress levels, which frequently enter plastic range. Design analysis is therefore, required to assure cyclic life and freedom from excessive deformation of structure. In a gas turbine, the weight of individual components must be as much minimum as possible, to achieve high thrust to weight ratio for the engine.

Correspondence to: Maryam Jae, Department of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, China, E-mail: maryam.j@subr.edu

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