LOW PRESSURE TURBINES DESIGN

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1. INTRODUCTION

The Low Pressure Turbine (LPT) module has a major contribution to the engine total figures. It can contribute with one third to the total weight and with up to 15% to the total cost. Its contribution to the specific fuel consumption (SFC) is also very important and typically the exchange ratio of LPT to engine efficiency is 1:0.7 for turbofans up to 1:1 for turboshafts. In terms of perceived noise, in modern engines with high by-pass ratio and low speed fans, the LPT may be an important source of noise, with a potential contribution of about 2 dB to the total engine noise in typical approach conditions. The working environment of these turbines is less agressive in terms of temperature and centrifugal stresses (at least for ungeared fan engines) than the High Pressure Turbines (HPT) and therefore some constraints in terms of internal cooling and area distribution for the rotor blades are usually less restrictive and the aerodynamic design of the profiles can be optimised to some extend. However for high speed LPTs the mechanical requirements for the rotors can affect dramatically the aerodynamic design and when services are needed to pass through a vane, its aerodynamic design may be affected very much, and so, the final module performance. Therefore a lot of different constraints must be taken into account when designing the LPT airfoils and usually the final decision on the optimum particular configuration requires a balance between the benefits and penalties on the different requirements (performance, life, weight, cost …).

As for any other aeroengine module design, the modern aerodynamic design LPTs includes not only clasical aerodynamic disciplines and methods, but also incorporate some other related disciplines as unsteady aerodynamics and aeroelasticity, heat transfer, and noise