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# Effect of Temperature Dependent Mechanical Properties on Thermal Stresses in Turbine Blabe

**A Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science in Mechanical Engineering**

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**November 2010**

## Abstract:

In recent years, there has been an increased interest in the design and analysis of critical components in gas and steam turbines. In aircraft applications, a gas turbine is an indispensable equipment for power generation for both the main and auxiliary systems. In current research the pure heat transfer problem has been solved as a predefined field for the purpose of stress analysis for a turbine blade with cooling. Since the blade is subjected to a hot pressurized flow which forces the rotor to rotate at its required speed therefore, the created stress by forces lead to fraction and corrosion on the blade. In this work, temperature and stresses fields in a gas turbine rotor are investigated using finite element method (FEM). According to the complexity of the geometry, a two dimensional modeling of a group of blade is created using a commercial CAD software. The details of this new approach are presented while stresses developed due to the turbine operating conditions at high rotational speed and thermal gradient by taking into account the material behavior at elevated temperatures K(T), E(T), α(T). Finally, these results compared with the results of the material behavior at constant properties. The results of blade with constant material properties have a good agreement with experimental results.

**Keywords:** Turbine blade, stress field, temperature distribution, temperature dependency, FEM.