BASIC COMPRESSIBLE FLOW
OVER A ROTATING DISK

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Received 02 : 01 : 2003 : Accepted 09 : 08 : 2004

Abstract
In this work the basic flow field is investigated for the compressible boundary layer flow over a rotating disk. Making use of self-consistent assumptions within boundary layer theory, the governing basic equations of motion are derived leading to a generalized steady compressible Von Karman flow. A Runge-Kutta integration method accurate to the fourth order is then employed for the solution of the resulting equations. Finally the velocity and temperature distributions corresponding to the various parameters are calculated numerically and presented.

Keywords: Compressible flow, Rotating-disk boundary layer, Runge-Kutta integrator.
2000 AMS Classification: 46 F 10

1. Introduction
The boundary layer flow due to a rotating disk has received substantial interest, in particular during the last two decades, since it constitutes a prototype for the flow over modern aircraft wings. Its significance lies in the fact that owing to the resemblance of the mean velocity profiles in cross flow directions, most of the fluid dynamical properties of the flow over a rotating disk and a swept-back wing almost coincide as far as the nature of instabilities is concerned. To be more precise, both flows are subject to cross flow vortices leading to convective or absolute instabilities.

A series of studies have been conducted to understand the reasons behind the instability mechanisms in three-dimensional boundary layer flows. Among these, the theoretical works of Gregory, Stuart and Walker [7], Malik [15], Malik, Wilkinson and Orszag [17], Mack [14], Hall [8], Bassom and Gajjar [3], Balakumar and Malik [2], Lingwood [11] and Türkyılmazoğlu [21] have highlighted the inevitable instabilities caused by the stationary or, in some circumstances, travelling disturbances. In particular, the latest two works have demonstrated that unlike the convective instability mechanism which arises in most three-dimensional boundary layer flows, the rotating disk boundary layer flow is subjected to absolute instability. Although the earlier experiments by Gregory, Stuart

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