NASA TECH BRIEF

Computer Program Calculates Velocities and Streamlines in Turbomachines

To obtain the velocity distribution and streamlines over widely separated blades (low solidity) of turbomachines (turbines or compressors), a computer program has been developed which gives the solutions of a two-dimensional, subsonic, compressible (or incompressible) nonviscous flow problem for a rotating or stationary circular cascade of blades on a blade-to-blade surface of revolution.

The program requires the basic cascade geometry, the meridional stream channel coordinates, fluid total conditions, weight flow, and inlet and outlet flow angles. The method of solution is based on the stream function with the solution of the simultaneous, nonlinear, finite-difference equations being obtained by two major levels of iteration. The finite difference equations are set up by the program from the basic geometry input. The inner iteration consists of the solution of simultaneous linear equations by successive overrelaxation, using an estimated optimum overrelaxation factor. The outer iteration then changes the coefficients of the simultaneous equations to compensate for compressibility. The output includes streamline coordinates, velocity magnitude and direction throughout the passage, and the blade surface velocities.

Notes:

1. This program is written in Fortran IV (95%) and MAP (5%) for the IBM 7094 II/7044 computer.
2. This program should be useful to many industries in the design of turbomachinery such as gas turbines, impellers for internal combustion engine superchargers, steam power turbines, jet engines and water turbines.
3. Inquiries concerning this program may be made to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B68-10097

Patent status:

No patent action is contemplated by NASA.

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