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NASA TECH BRIEF

(MAGNFY) Program for Calculating Velocities in Magnified Region of Turbomachines

The problem:

To obtain the velocity distribution through the passage between and particularly over the blade surfaces of blade rows for turbines and compressors, especially the velocities around leading or trailing edge radii and within slot regions.

The solution:

MAGNFY was developed to obtain velocities on smaller-than-normal finite difference mesh in any part of the blade-to-blade passage.

How it's done:

Programs have been published to obtain velocity distribution through the passages and over blade surfaces of single and tandem blade rows. Using these programs, however, it is not always possible to obtain sufficient detail on some critical parts of the blade surfaces such as around the small leading or trailing edge radii or within slot regions. It is within these regions that geometry, and thus velocities, change most rapidly.

This program, therefore, uses input of the other programs (2DCP, TURBLE, TANDEM) to obtain a solution on a fine mesh in a small part of the blade-to-blade region. The output is similar to that of the other three programs and includes detailed surface velocities, velocity magnitude and direction, and stream function values throughout the magnified region. In essence, the program yields a local detailed solution around the leading or trailing edge or in a slot region for compressible, subsonic, non-viscous flow on a blade-to-blade surface between two turbomachine blades.

A course mesh solution for an entire blade-to-blade region can be magnified by a chosen magnification factor in a small rectangular region. The method 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 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 coefficient of the simultaneous equations to compensate for compressibility.

Notes:

1. This program is written in FORTRAN IV language for use on the IBM 7094 computer.
2. Inquiries concerning this innovation may be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B69-10132

Patent status:

No patent action is contemplated by NASA.

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