NASA TECH BRIEF

Geometry and Design Point Performance of Axial Flow Turbines

The problem:

To develop a non-restrictive method for determining the alternative geometries and associated design point performance of axial-flow turbines capable of satisfying specified design requirements.

The solution:

ProgramTD(Turbine Design) is a computer program that solves the flow field within the turbine without making the simplifying assumptions that result in restrictive designs.

How it's done:

The program is capable of analyzing both single and multispool units (a maximum of three spools is allowed), and each spool may have up to eight stages. The absolute and relative flow fields are computed at the first stator inlet, at each interblade row plane, and at the final rotor exit. The effects of the radial variation of the following quantities are taken into account: inlet conditions, streamline angle of inclination and curvature, loss coefficient or efficiency, whirl velocity or angle, and power output. Further, the effects of coolant flows, interfilament mixing, and a station-to-station variation of specific heat can be included. As additional features, the program allows for: (1) the internal calculation of losses based on a correlation which has been developed for pressure-loss coefficient, and (2) either subsonic or supersonic solutions for the absolute velocity.

The program will determine the standard turbine design parameters at a preselected number of streamlines. These parameters will be consistent with the requirement of radial equilibrium, the specified or calculated blade element performance, and the input specifications of design requirements. When used for the analysis of a single spool, designs for any number of sets of analysis variables may be computed consecutively.

Notes:

1. This program is written in FORTRAN IV language for use on the IBM 7094/7044 Direct Couple System.

2. Inquiries concerning this innovation may be directed to:

> COSMIC
> Computer Center
> University of Georgia
> Athens, Georgia 30601
> Reference: B69-10111

Patent status:

No patent action is contemplated by NASA.

> Source: Anthony F. Carter and Melvin Plott
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