NASA TECH BRIEF

Computer Program for the Design of Axial-Flow Turbines

The problem:

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

The solution:

Program TD 2 (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, each with up to eight stages, is allowed. The absolute and relative flow fields are computed at the first stator inlet, at each interblade row plane, and at the final rotor exit. Radial variation effects of the following quantities are taken into account: inlet conditions, streamline angle of inclination and curvature, loss coefficient or efficiency, and meridional velocity or angle. Further, the effects of coolant flows, interfilament mixing, and station-to-station variation of specific heat can be included. The program internally calculates losses, based on a pre-developed correlation for pressure-loss coefficient; and either subsonic or supersonic solutions can be used to determine the absolute velocity.

Standard turbine design parameters can be determined at a preselected number of streamlines. These parameters will be consistent with radial equilibrium requirements, specified or calculated blade element performance, and input specifications defining design requirements. When used for the analysis of a single spool, the program can consecutively produce designs for any number of sets of analysis variables.

Notes:

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

2. This program is an updated version of the computer program described in NASA Tech Brief 69-10111, "Geometry and Design Point Performance of Axial Flow Turbines."

3. Inquiries may be directed to:
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Patent status:

No patent action is contemplated by NASA.

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