

# NASA TECH BRIEF

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### Computer Program for Preliminary Design Analysis of Axial-Flow Turbines

A computer program has been developed for the preliminary design analysis of axial-flow turbines. The computations are based on mean-diameter flow properties and do not consider any radial gradients. Specific heat ratio is assumed constant throughout the turbine. For any given turbine, all stages, except the first, are specified to have the same shape velocity diagram. The first stage differs only in that the inlet flow is axial. The velocity diagram shape depends upon the speed-work parameter value and the specified type of velocity diagram. Any of three types of velocity diagrams can be specified: symmetrical, zero exit swirl, or impulse. Exit turning vanes can be included in the design.

Input design requirements include power or pressure ratio, mass flow rate, inlet temperature and pressure, and rotative speed. The design variables include inlet and exit diameters, stator angle or exit radius ratio, and number of stages. Gas properties are input as gas constant, specific heat ratio, and viscosity.

The program output includes inlet and exit annulus dimensions, exit temperature and pressure, total and static efficiencies, blading angles, and last-stage critical velocity ratios.

#### Notes:

1. All computations are performed in one main program written in IBM 7090/7094 FORTRAN IV language.
2. The computations can be done either in SI units or in US customary units.
3. Inquiries concerning this program should be directed to:

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