NASA TECH BRIEF

Lewis Research Center

Data Summary and Computer Program for Axial-Flow Pump Rotor Performance

A carefully selected and evaluated assembly of non-cavitating blade element performance data for axial-flow pump rotor configurations has been collected and organized. A digital computer program has been developed to facilitate handling the large amount of experimental data involved. Both the data and the computer program are useful to the analysis and design of axial-flow pumps, compressors and blowers.

Since 1958, NASA has carried out a comprehensive research program on pumps for liquid propellant rocket systems. One important phase of the research on axial-flow pumps has been extensive experimental investigation of rotor blade rows operating in water. A wide range of rotor geometries has been investigated using consistent design techniques and test conditions. The results are believed to be the most complete collection available of detailed experimental performance data on axial-flow pump blade rows. In support of research on the prediction of axial-flow pump performance, data for twelve rotor configurations have been evaluated and correlated for analysis and design use. The rotor configurations were selected for a systematic study to show the effects of design parameters such as blade loading, flow coefficient, radius ratio, tip clearance, and energy addition distribution on the performance of a class of rotors composed of high-inlet-relative-flow angle, high-head-rise blade rows operating in an annulus having constant-diameter hub and casing surfaces. Rotor design philosophy, testing and data reduction and evaluation are also discussed.

A computer program has been developed to read, reduce, and systematically store and printout the collected data. The program will handle isolated rotor or stage data measured upstream and downstream of blade rows. This program may also be used for purposes other than producing output from the tabulated data. For example, it can be used as a data reduction program to process flow and performance measurements from other axial-flow pump configurations.

Notes:

1. Except for the generally higher level of pump rotor blade chord Reynolds numbers involved, the flow conditions associated with the assembled data are quite similar to those existing in the rear stages of industrial multistage axial-flow compressors, and in fan and blower configurations with high hub-tip ratios.
2. The computer program is written in FORTRAN IV for use on the IBM 360 computer.
3. Inquiries concerning the documented data and/or the computer program should be directed to:
   COSMIC
   Information Services
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30602
   Reference: LEW-11920

Source: M.J. Miller, T.H. Okiishi and G.K. Serovy
Iowa State University
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D.M. Sandercock and W.R. Britsch
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