NASA TECH BRIEF

Lewis Research Center

A Method for Calculating the Effects of Design Errors and Measurement Errors on Pump Performance

A method has been developed for calculating the effects of design errors and measurement errors on pump performance. Error equations and charts are utilized to relate the amount of error in a given performance parameter to the amount of error in a given design or measured variable.

Calculation of the effect of design errors is useful in pump design. It can show the sensitivity of a given design to design errors and manufacturing tolerances. It can be used to estimate the precision of a design, i.e., the limits around the design point within which the pump performance may be expected to lie with reasonable certainty. An analysis of the effect of errors can also show which step in a design procedure is the most critical source of error.

Calculation of measurement errors is important in evaluating pump test data. Mathematical techniques can be applied to analyze the effects of measurement errors on pump performance parameters. Using these techniques the amount of error to be expected in performance parameters can be calculated from estimates of the errors introduced by different measurements. An error analysis can also be used in planning instrumentation by showing which measurement is likely to introduce the largest errors.

In comparing design performance with measured performance, both design errors and measurement errors must be considered.

The error equations were derived primarily for axial flow pumps, but are not limited to axial flow. All of the design error equations and measurement error equations are correct for mixed-flow impellers and centrifugal pumps if the meridional velocity is substituted for axial velocity. However, the error equations apply to a design system and test procedures which are standard for axial flow pumps, but are not always used for mixed-flow impellers. The equations, as written, apply to rotors but can be modified for application also to stators.

Notes:

1. The following documentation may be obtained from:
    National Technical Information Service
    Springfield, Virginia 22151
    Single document price $3.00
    (or microfiche $0.95)

    Reference: NASA TN-D-5919 (N70-33164), An Analysis of the Effect of Design and Measurement Errors on Pump Performance Parameters

2. Technical questions may be directed to:
    Technology Utilization Officer
    Lewis Research Center
    21000 Brookpark Road
    Cleveland, Ohio 44135
    Reference: B72-10292

Patent status:

No patent action is contemplated by NASA.

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