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BLADE-SECTION DESIGN FOR AXIAL FLOW FANS

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S U M M A R Y

It is current practice to use a wide variety of aerofoil types in the design of fan blading, often for identical design duty conditions. It is reasonable to assume, however, that for each particular design duty requirement there must exist a specific blade contour which represents the optimum design solution. Incorrect premises, or insufficient data, can lead to a poor choice of blading with subsequent performance and operational penalties.

In this paper a systematic approach to blade section design is indicated. Commencing with fundamental considerations in respect to deflection, lift, drag, and efficiency over a wide range of duty conditions it is possible to specify the main design features of the near-optimum blade section, as a function of the relevant overall design parameters.

Considerable use is made of data and findings obtained from the comprehensive and systematic tests carried out by the NACA in the 1930's. A link is established between this work and current compressor blading practice. The near-optimum fan blade section has the following characteristics; a thickness form resembling that of the Clark Y, this thickness form is bent around a circular arc camber line, the degree of camber is a definite function of the air turning angle, and the thickness/chord ratio is approximately 10% c. A composite camber line incorporating increased nose camber, approximating that of the NACA 230 aerofoil series, is considered to possess desirable design features in regard to fan blading, particularly in the critical Reynolds number range.

The deviation angle and the optimum local incidence angle are important design variables where the interference effect between blades is significant. These design parameters are discussed in sufficient depth to permit a rational approach to fan blading design, for varying solidities. The application of the data to design situations is indicated.

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