Journal of Engineering for Gas Turbines and Power

Discussion

Holographic Measurements and Theoretical Predictions of the Unsteady Flow in a Transonic Annular Cascade[1]

S. G. Newton[2]

1 Since the phase of unsteady pressure is important with respect to stability, it would be interesting to see phase data presented. Does the statement in Section 2 that the phase was unreliable imply low coherence between unsteady pressure and blade motion?

2 In Section 4 it should perhaps be emphasized that the calculations were performed with a large amount of artificial viscosity, the density being upwinded by one element.

3 (*i*) If an appropriate oblique shock solution were compared with Fig. 8 then the Mach number jump would closely match the Finsup value. (*ii*) A solution with the shock on the suction surface trailing edge could result in errors, since the cusp will be highly loaded and the implementation of the Kutta condition is in doubt.

4 In Section 5 the leading edge shock is described as normal (as shown in Fig. 6), but it is also described as weak. In the strict sense a normal shock must be strong, i.e., subsonic downstream of the shock. Furthermore, if the leading edge shock is attached, there can be no series of weak shocks from adjacent blades. There seems to be an inconsistency between this and the requirement for the Mach number ahead of the leading edge to be close to unity.

5 The 315 deg position sketch in Fig. 18 (β = 180 deg) appears to differ from that of Fig. 14 (photograph of hologram); the same is true for the 90 deg position case of Figs. 15 and 14 (β = 135 deg).

6 If one plots out shock position on the blade surface both the leading edge shock intersection with the suction surface and the trailing edge shock intersection with the pressure surface appear harmonic only over the first 180 deg of the motion. This observation is based only on approximate measurements from Figs. 17 and 18, but does seem to be consistent with the discussion in Section 7.

Author's Closure

I should like to thank Dr. Newton for the points he raises on the paper. I shall comment briefly on these and where I make no comment I am in agreement with him.

1 The problem here was more of the instrumentation being unable to measure the pressure phase accurately after the signal was filtered. In saying this, however, it is implied that we had little knowledge of coherence save that which was obtained by viewing the unfiltered signals on an oscilloscope: They then looked to be coherent.

4 Firstly I see nothing wrong in describing a weak normal shock as "weak." Secondly, the upstream shock to which we refer is shown at the 45 deg position of Fig. 15 as an extension of the leading edge shock. As this lies in front of the passage shock above it will weaken it.

5 It is difficult to make any direct comparisons between the sketches and the photographs. The sketches were made by looking around a three-dimensional hologram; it is only then that the true shock positions can be found. The optical distortions which exist can best be illustrated by the position of the blade mounting pin in the center of Fig. 14. This should be at 50 percent chord with the chord as a diameter.

[1] By M. R. D. Davies and P. J. Bryanston-Cross, published in the April 1985 issue of the Journal of Engineering for Gas Turbines and Power, Vol. 107, No. 2, pp. 450–457.

[2] Rolls-Royce Limited, Derby, England

The Effects of Reynolds Number on the Efficiency of Centrifugal Compressor Stages[1]

C. Rodgers.[2] The asymptotic trend of equation (22) toward a constant C = 5.0 for impeller width-to-diameter ratios (b_2/D_2) greater than 0.06 would appear to be inconsistent with the trend of increased passage curvature losses in very high specific speed impellers.

Additional test data are required for such impellers in order to refine the author's excellent correlation of Reynolds number effects.

Author's Closure

I agree with Mr. Rodgers that additional test data are needed for stages with high width-to-diameter ratio (b_2/D_2), in order to refine the correlation given in the paper. I do not agree, however, that the constant value of c given for wide impellers is inconsistent. Firstly, roughly half of the Reynolds-dependent friction losses occur in the diffuser and are unaffected by the curvature of the impeller passages. Secondly, it is not clear that the additional losses due to passage curvature in the impeller are strongly dependent on the Reynolds number.

Combined-Cycle System With Novel Bottoming Cycle[3]

G. J. Silvestri, Jr.[4] This paper, which is an extension of a concept presented in ASME Paper No. 83-JPGC-GT-3, applies principles used in ammonia absorption refrigeration to power generation cycles. The data which are presented indicate substantial improvements in energy conversion efficiency and significantly lower power costs.

The choice of working fluid and operating conditions raises

[1] By M. V. Casey, published in the April 1985 issue of the Journal of Engineering for Gas Turbines and Power, Vol. 107, No. 2, pp. 541–548.

[2] Turbomach, San Diego, CA

[3] By A. I. Kalina, published in the October 1984 issue of the Journal of Engineering for Gas Turbines and Power, Vol. 106, No. 4, pp. 737–742.

[4] Steam Turbine Generator Division, Westinghouse Electric Corporation, Orlando, FL 32817.