Effects of Inducer Geometry

In this section we comment on several geometric factors for which the data suggests optimum values. Clearly, the solidity, s, needs to be as small as possible and yet large enough to achieve the desired discharge flow angle. Data on the effect of the solidity on the performance of a 3-bladed, 9° helical inducer

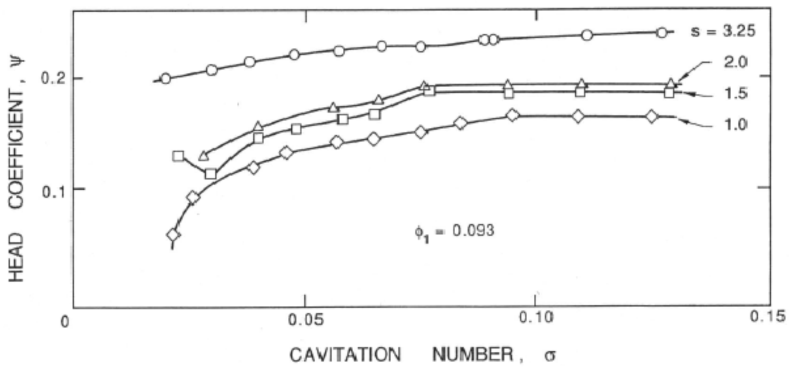

Figure 1: The effect of solidity on the cavitation performance of a 9° helical inducer (from Acosta 1958).

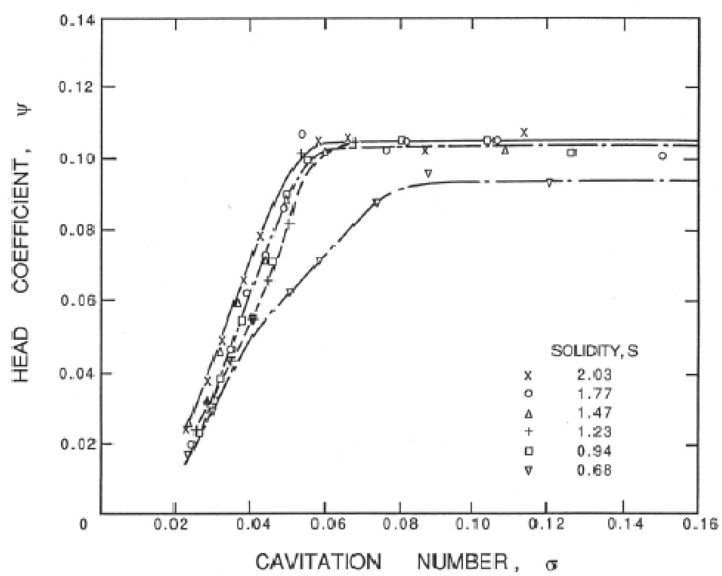

Figure 2: The effect of solidity on the cavitation performance of a cavitating inducer (Janigro and Ferrini 1973 from Henderson and Tucker 1962).

has been obtained by Acosta (1958) and on a 4-bladed, $8\frac{1}{2}^\circ$ helical inducer by Henderson and Tucker (1962). This data is shown in figures 1 and 2. The effect on the non-cavitating performance (extreme right of the figures) seems greater for Acosta's inducer than for that of Henderson and Tucker. The latter data suggests that, as expected, the non-cavitating performance is little affected unless the solidity is less than unity. Both sets of data suggest that the cavitating performance is affected more than the non-cavitating performance by changes in the solidity when the latter is less than about unity. Consequently, this data suggests an optimum value of s of about 1.5.

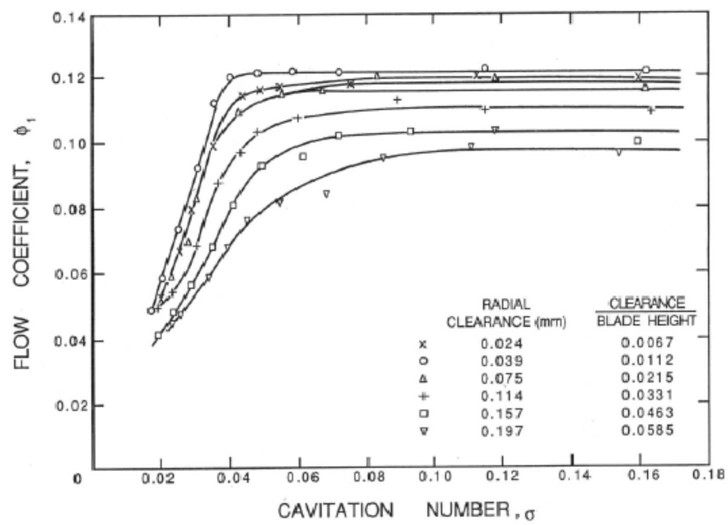

Figure 3: The effect of tip clearance on the cavitation performance of a cavitating inducer (from Henderson and Tucker 1962 as given by Janigro and Ferrini 1973).

The same two studies also investigated the effect of the tip clearance and the data of Henderson and Tucker (1962) is reproduced in figure 3. As was the case with the solidity, the non-cavitating performance is less sensitive to changes in the tip clearance than is the cavitation performance. Note from figure 3 that the non-cavitating performance is relatively insensitive to the clearance unless the latter is increased above 2% of the chord when the performance begins to decline more rapidly. The cavitating performance shows a similar dependence though the fractional changes in the performance are larger. Note that the

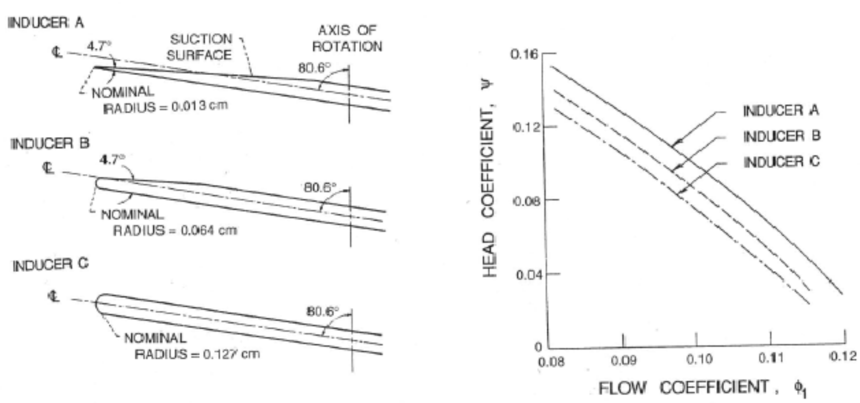

Figure 4: Non-cavitating performance of three 9.4° helical inducers with different leading edges as shown. Tests performed with liquid hydrogen (from Moore and Meng 1970b).

performance near the knee of the curve indicates an optimum clearance of about 1% of the chord which is in general qualitative agreement with the effect of tip clearance on cavitation inception discussed earlier (see section (Mbeg)).

Moore and Meng (1970a,b) have made a study of the effect of the leading edge geometry on inducer performance and their results are depicted graphically in figures 4 and 5. Note that the leading edge geometry has a significant effect on the non-cavitating performance and on the breakdown cavitation number. Simply stated, the sharper the leading edge the better the hydraulic performance under both cavitating and non-cavitating conditions. There is, however, a trade-off to be made here for very thin leading edges may flutter. This phenomenon is discussed in section (Mbfm). Incidentally, figure 5 also

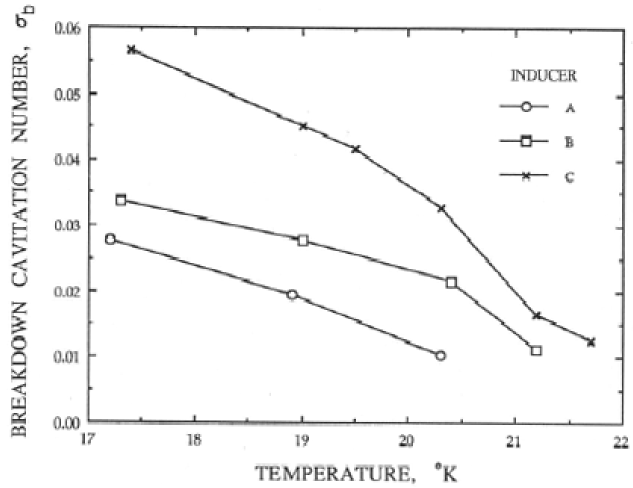

Figure 5: The breakdown cavitation numbers, σ_b (defined in this case by a 30% head drop) as a function of temperature for three shapes of leading edge (see figure 4) on 9.4° helical inducers operating in liquid hydrogen (from Moore and Meng 1970a,b).

demonstrates the thermal effect on cavitation performance which is discussed in section (Mber).