Question:

We are working on cases related to droplet impingement and we would like to count on your support to clarify the aspects below:

1- Regarding case 121, experimental data presented in file “IPW1-case-descriptions-20210318.pdf”, slide 9 are related to which vertical section of airfoil?

2- Regarding cases 111 and 112 (slides 6 and 7), could you please inform me which is the vertical section related to chord 45.75 inches mentioned in experimental results?

Answer

For cases 111 and 112, the pressure measurements are taken at 24 and 43 inches , and the collection efficiency at 36 and 44 inches above the tunnel floor. Local chord length needs to be used at the cut location for X/C.

For cases 121 and 122, the three element airfoil, collection efficiency location is reported as "midspan".

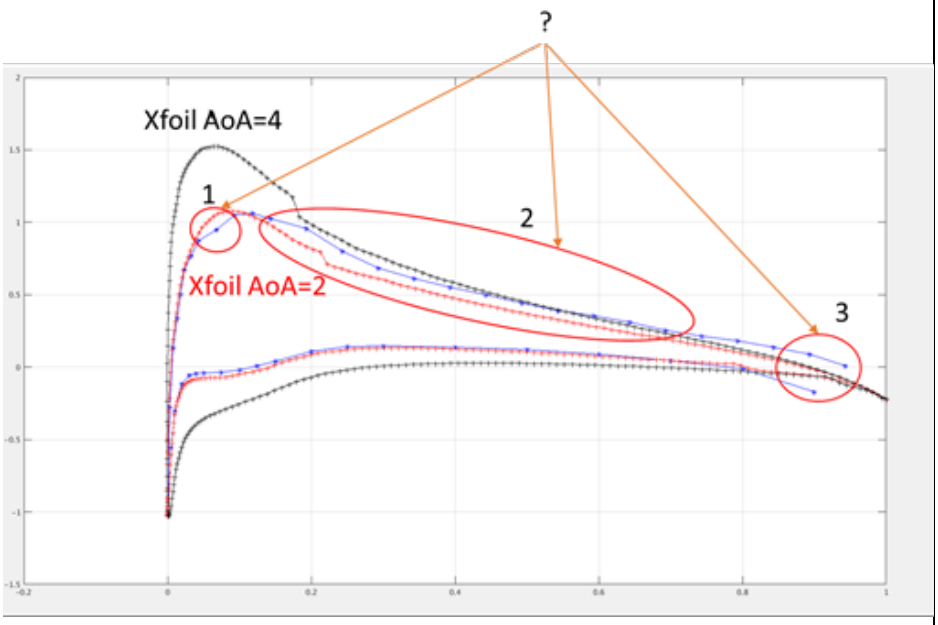
Question

The Cp distribution in the suction side (and the last point before the TE in the pressure side), seems still quite “weird” when compared with other experimental CP available in the literature or when compared with numerical simulations.
I will use the distribution predicted with xfoil, to help me out in describing what I think is “weird” (see picture below).
I see 3 problems in the experimental CP that would need an explanation:

1. Close to the LE there is a discontinuity in the CP. Is that measurement error or there is a physical explanation?
2. the suction side (from 0.2 X/c to the TE) the pressure is really low (e.g., I get that values for AoA around 4 deg).
3. Something is happening, either at the pressure side or at the suction side, at the TE.

Normally I would investigate the experimental report to clarify the above points, since such big deviations should be mentioned on it, but in this case we have just the distribution.

Do you think it exists a report on these measurements? Could you get more information?



Answer

1. This discontinuity is most likely some type of measurement error resulting from some issue with the pressure tap or tubing leading to the transducer. The model itself could be considered high fidelity (CNC machined), so this was not likely to be caused by some local surface defect.

2. It looks like XFOIL is suggesting boundary layer transition occurs near x/c = 0.2. Unfortunately, the experimental Cp data do not have sufficient spatial resolution to determine the transition location. So there could be some mismatch of transition location that is affecting the comparison.

3. I agree that the experimental Cp in this region are not well behaved. I would attribute this to measurement uncertainty and potential problems with the pressure tap or tubing leading to the transducer.

General comment: I have seen surface pressure data from the IRT over the course of nearly 20 years and it typically has these kinds of issues. Part of the problem is that the test articles are constantly subjected to cold and wet conditions which ultimately degrade the pressure taps and internal tubing, despite efforts to cover the taps and protect the tubing. Also, the pressure measurement system at IRT does not offer optimal full-scale ranges for surface pressure that is typically found in aerodynamic wind tunnels. For example, the magnitude of the trailing edge

pressures are very low, but these are measured on the same transducer full-scale range as the leading edge pressures. One outcome of this workshop could be to make recommendations for higher accuracy surface pressure data and why that is needed for more accurate ice prediction.