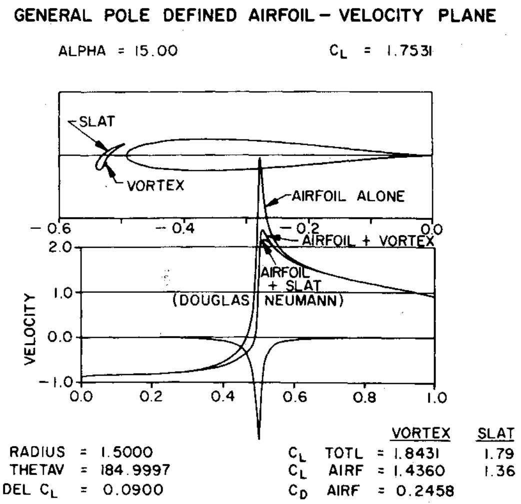

Fig. 6 Results for Example 2. Comparison of point vortex with a real slat using the Douglas Neumann potential flow program.

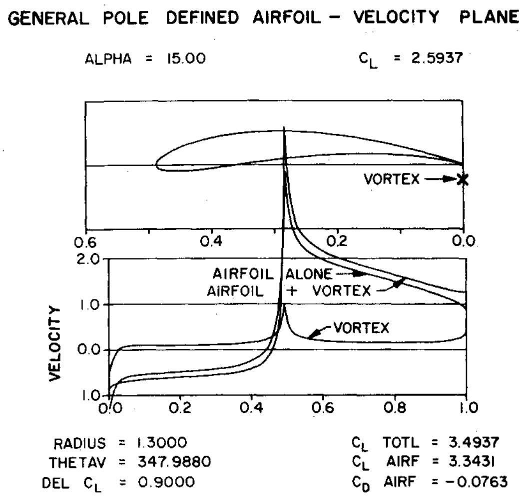

Fig. 7 Results for Example 3. Point vortex used to simulate a slotted flap.

$+ \; C_{D_A}{}^2)^{1/2}$ was equal to the total load on the slat as calculated from the Douglas Neumann program results. The resulting modulation distributions from both the point vortex and the slat are shown in Fig. 6, along with the values for C_{L_T} and C_{L_A}. The slat provides slightly more modulation than the vortex and thus the total lift of the slat plus airfoil system ($C_{L_T} = 1.79$) is less than that point vortex plus airfoil system ($C_{L_T} = 1.84$) for the same loading of the slat and point vortex.

Since the slat is positioned less than its chord length away from the nose of the airfoil, the above result is not surprising. It is expected that the distributed vorticity along the slat chord (as used in Ref. 4) would provide more effective modulation than the concentrated vorticity of the point vortex. However, these results do demonstrate that using a point vortex to represent a slat as a first-order theoretical model is a reasonable approach.

Example 3

The point vortex can also be used to simulate a slotted flap at the airfoil trailing edge. An example of this is shown in Fig. 7 where the vortex is located just below the trailing edge. The circulation about the flap (point vortex here) causes an acceleration of the flow near the trailing edge. However, this also increases the velocity peak at the leading edge as can be seen in Fig. 7 which calls for a leading edge slat (or, in the present context, a second point vortex). At this time, the pole-airfoil-plus-point-vortex program does not have the capability for generating two independent point vortices, but it appears that this would be a logical next step in developing the program.

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Errata

Application of Thermal Barriers to High-Temperature Engine Components

R. L. Newman, K. R. Cross, and W. C. Spicer
Detroit Diesel Allison Div., General Motors Corporation, Indianapolis, Ind.
and
H. D. Sheets and T. D. Driskell
Battelle Memorial Institute, Columbus, Ohio

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Reference

[1]R. L. Newman, et. al., "Application of Thermal Barriers to High Temperature Engine Components," Paper 21-C-71F, American Ceramic Society, Ceramic-Metal Systems Div., Fall Meeting, St. Louis, Mo., Sept. 1971; also Detroit Diesel Allison Rept. RN-71-55, (Sept. 1971); also NTIS No. N72-24822.

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