



$\alpha = 35 \text{ deg}$

Fig. 3 Vortex flow behind delta wing:  $A = 0.56$  and  $Re_c = 1.32 \times 10^5$  (Ref. 6).

sider that use of the half-model test technique eliminates the phenomenon of asymmetric vortex breakdown, illustrated in Fig. 3 already at  $\alpha = 35 \text{ deg}$  for an 82-deg sharp-edged delta wing.<sup>6</sup>

### References

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## Reply by the Authors to L. E. Ericsson

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**R**EGARDING the remarks in the first paragraph, it would indeed be insightful to study further the high sensitivity associated with proximity to a critical state. This will require an investigation of a range of angle of attack and detailed characterization of the instantaneous flowfield in terms of effective swirl and axial velocity components.

The issues of effective angle of attack and sweep angle for a rounded vs a sharp leading edge are intriguing and deserve further study. It will be appropriate to provide a basis for interpreting these effective angles in terms of the detailed structure of the leading-edge vortex for a rounded vs sharp edge.

Regarding the difference in structure between the breakdown from a sharp edge and a rounded edge with blowing, again detailed

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characterization of the swirl and axial velocity fields would be required. As the magnitude of the tangential blowing velocity increases, it would tend to enhance the swirl velocity, and it is expected that a limiting value of the ratio of swirl to axial velocity would be reached, for which any further increases would actually tend to enhance the onset of vortex breakdown and move its location toward the apex.

Taken as a whole, the issues raised point to the need for further studies of the quantitative structure of the flowfield. In fact, studies of the flow past a delta wing at high angle of attack subjected to various types of local control are currently under investigation in our laboratories.

## Comment on "Nonlinear Response of Asymmetrically Laminated Plates in Cylindrical Bending"

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A recent Technical Note by Carrera<sup>1</sup> suggested that the von Kármán large deflection plate theory<sup>2,3</sup> was not suitable for analysis of asymmetric composite plates. His conclusions were based on the discrepancy found in the comparison of the analytical solutions obtained by Sun and Chin<sup>2,3</sup> with his nonlinear finite element solutions. In his finite element analysis Carrera erroneously modeled the cylindrical bending problem as a thin laminate strip with free boundary conditions. This explains why his finite element solutions could not match the analytical solutions, thus leading him to incorrect conclusions.

### References

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## Reply by the Author to C. T. Sun

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First of all I have to reply that in Ref. 1 I did not suggest that the von Kármán large deflection plate theory was not suitable for analysis of asymmetric composite plates. In fact I used this nonlinear theory in the FEM model employed in Ref. 1. Instead in my Note<sup>1</sup> concerning the cylindrical bending case, I mainly remarked what is in the following text:

1) The analysis in Ref. 2 is a linearized one in the sense that the load-deflection curve has the Euler buckling load as asymptote.

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