# Computational Study of the Vortical Flow over a Yawed LEX-Delta Wing at a High-Angle of Attack

Tae-Ho Kim[a], Bok-Hyun Yoon[a], Heuy-Dong Kim[b] and Myong-Hwan Sohn[c]

*a. Dept. of Mechanical Engineering, Mokpo National University, Jeonnam, Korea*
*b. Dept. of Mechanical Engineeirng, Andong National University, Kyoungbook, Korea*
*c. Dept. of Aerospace Engineering, Korea Air Force Academy, Chungnam, Korea*

Abstract

Many modern combat or supersonic airplanes which are required a high maneuverability performance have adopted the delta wing which have ability to minimize the influence of the shock wave generated in the vicinity of the sound speed area and to maintain stability at the moment of supersonic aviation. Many problems exist with regard to sudden reduction of maneuverability and generation of induced drag at low speed area, difficulty in use of high-lift device and requirement of high-angle of attack at takeoff or landing owing to stall generation. The vast majority of delta-winged aircraft spends a great deal of their flight time at subsonic speeds. For this reason, the low-speed aerodynamic characteristics of delta wings are also of great importance. Therefore, the low-speed aerodynamics of delta wings has been a subject of much study.

In order to investigate the votical flow characteristics over a yawed LEX-delta wing at a high-angle of attack, computational analysis has been carried out. The computational was extended at 6 times of chord length toward upstream from the apex of the wing, 15 time of chord length toward downstream from trailing of the wing and 8 times of chord length along the spanwise(see, Fig.1). The pressure inlet boundary condition, the pressure outlet boundary condition and the far-field boundary condition are applied to the upstream boundary, downstream boundary and circumferential boundary of the computational domain, respectively. The total number of cells is approximate 800,000. The Reynolds number based on the free stream velocity and the wing chord length was about $0.88 \times 10^6$.

The present study investigates numerically and experimentally the vortex flow characteristics of a sharp-edged delta wing with a leading edge extension according to the variation of yaw angle. In computations, the yaw angle is varied between 0 and 20 degree and the free stream velocity is fixed in 20m/s. The results obtained from the present computations are compared with the experimental ones and visualize path line, density contour, total pressure contour, vorticity, particle trajectory etc. which are hardly disclosed by experimental work(see, Fig.2).

---

Correspondent: Tae Ho Kim

Dept. of Mechanical Engineering, Mokpo University, 61, Dorim-ri, Chungkye-myon, Muan-gun, Jeonnam, 534-729, Korea

Tel: +82-61-450-6407, Fax: +82-61-452-6376, E-mail: kimth973@hanmail.net



Paper No. : 3-3B-2

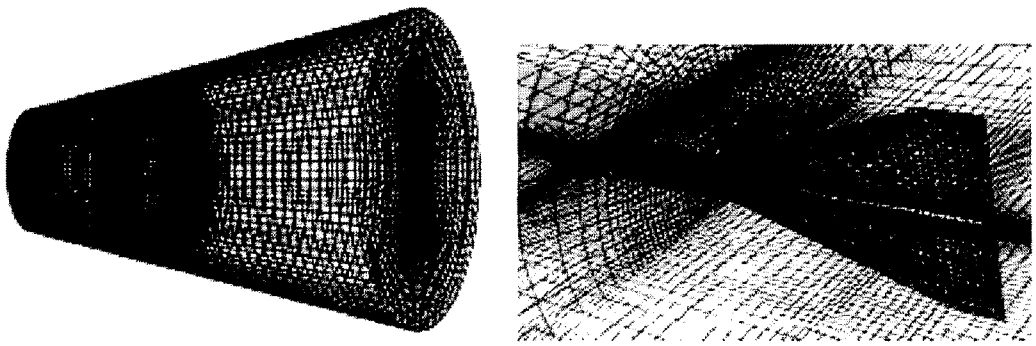

**Fig. 1** Computation domain and grid system around a LEX-delta wing

(a) $\beta$=0° (b) $\beta$=10° (c) $\beta$=20°

**Fig. 2** Path lines over the upper surface of the delta wing