PROPRIETA' GEOMETRICHE ALA

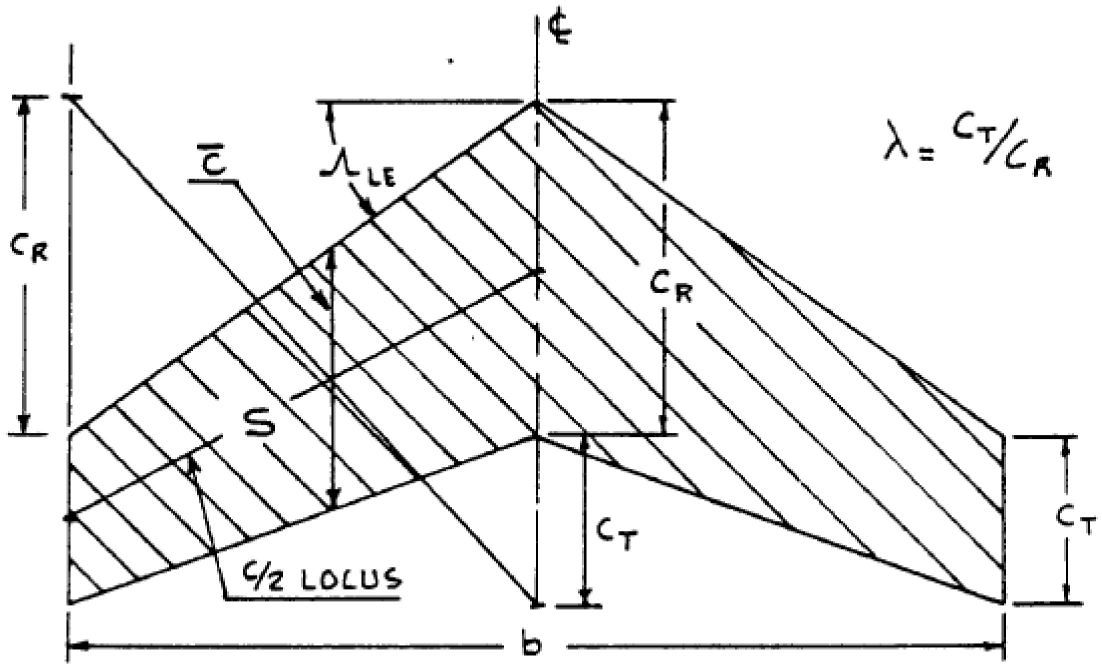


Figure 2.5 Reference Geometry for Straight, Tapered Wings

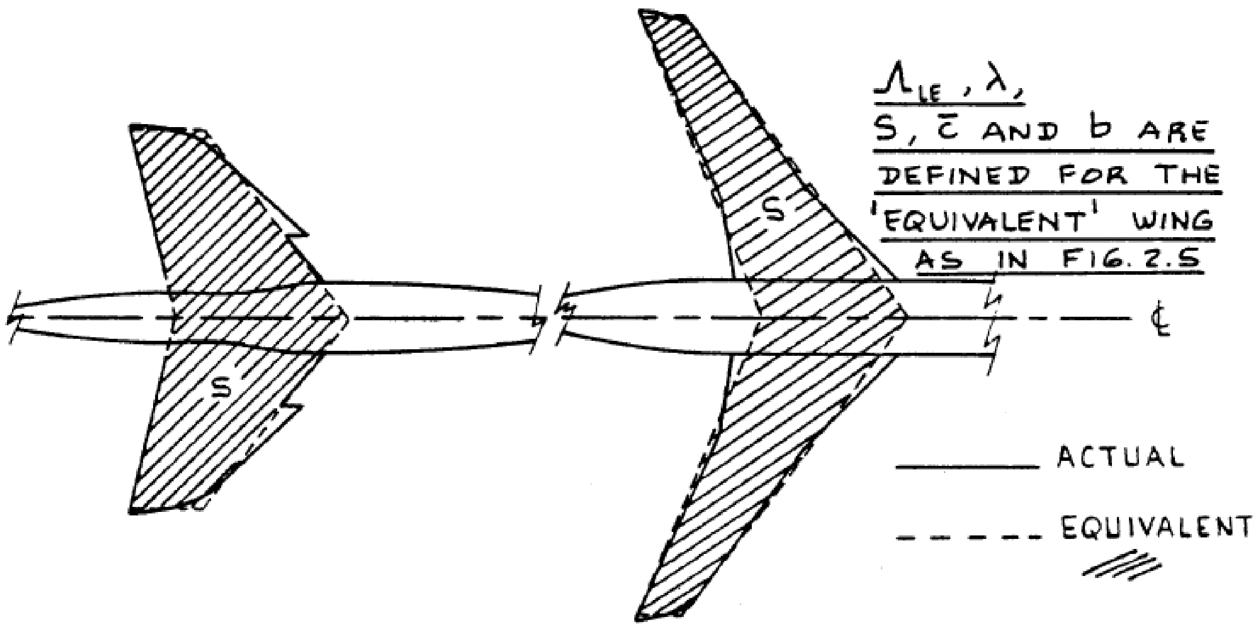
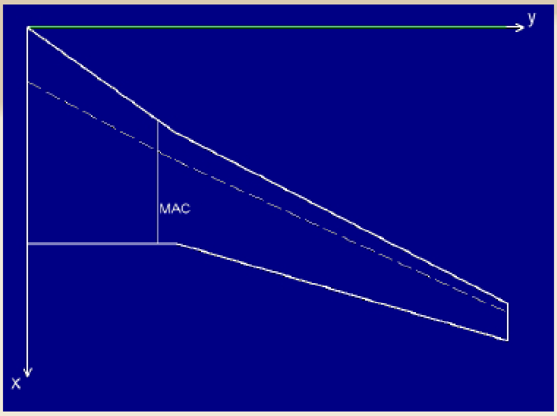


Figure 2.6 Reference Geometry and Equivalent Planform for Non Straight, Tapered Wings

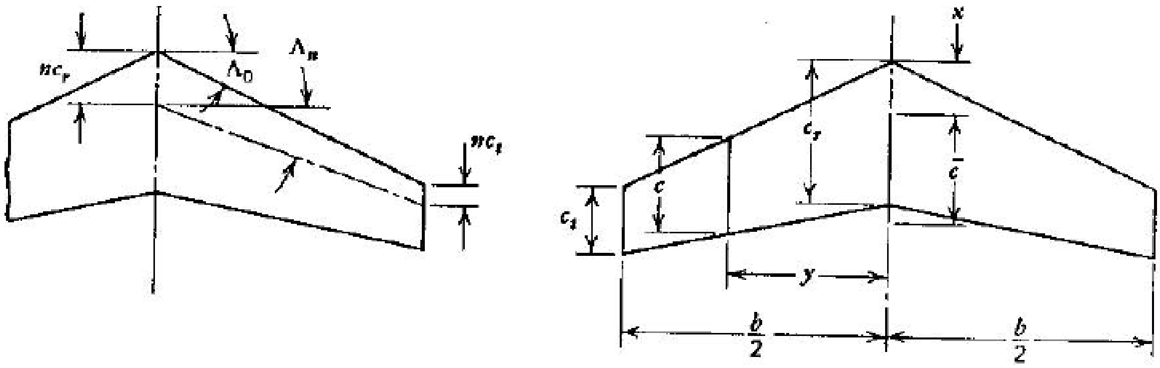
Corda media aerodinamica



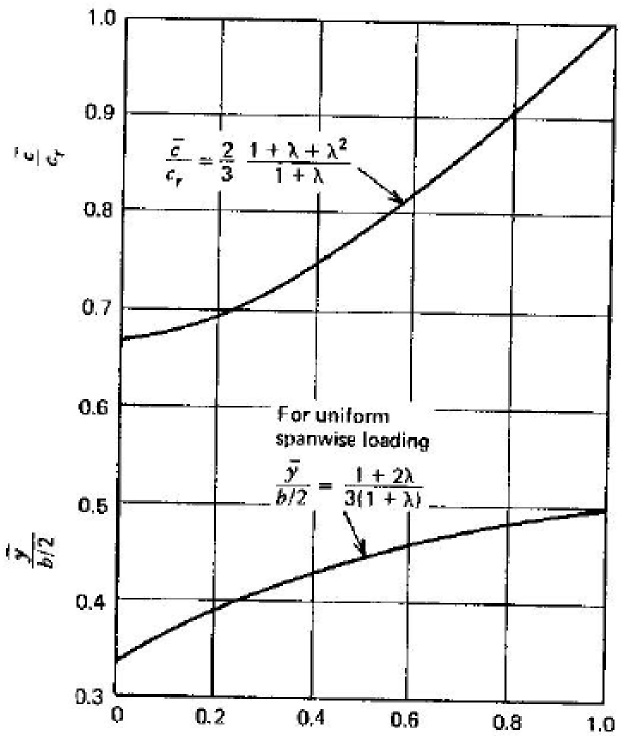
$$MAC = \frac{2}{S} \cdot \int_0^{\frac{b}{2}} c^2(y) \cdot dy$$

$$x_{MAC} = \frac{2}{S} \cdot \int_0^{\frac{b}{2}} x_{l.e.}(y) \cdot c(y) \cdot dy$$

$$y_{MAC} = \frac{2}{S} \cdot \int_0^{\frac{b}{2}} y \cdot c(y) \cdot dy$$

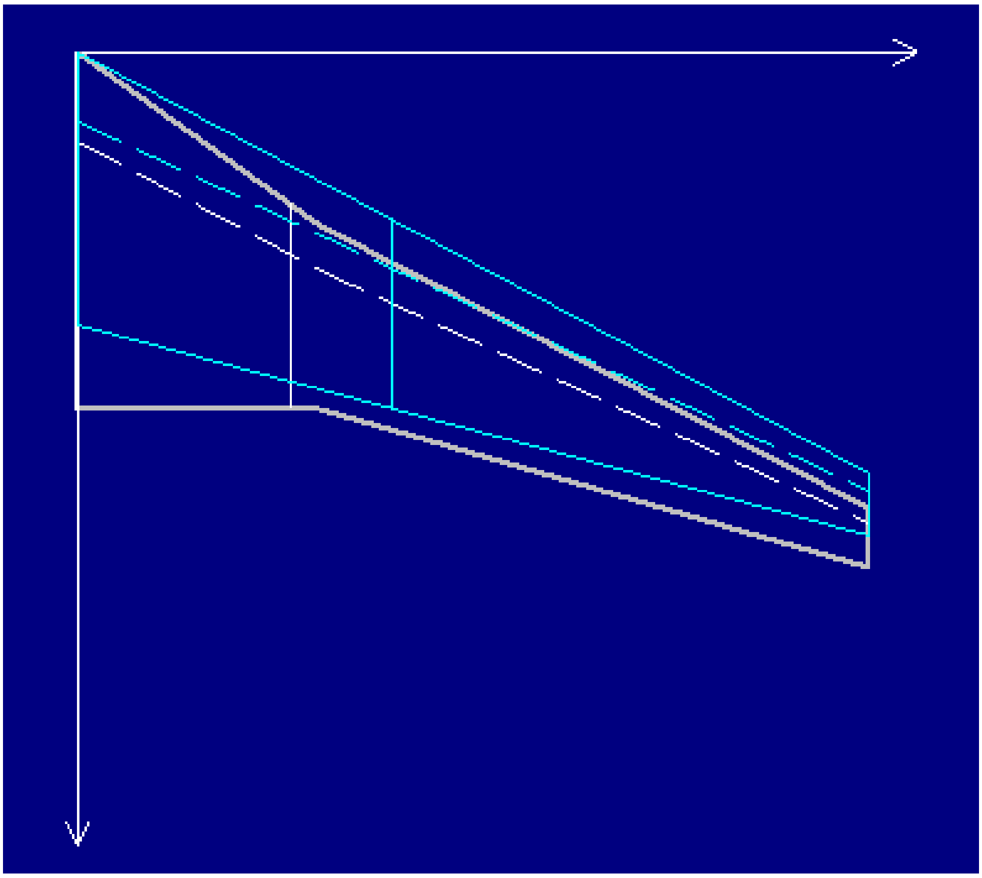


Calcolo della corda media per ali semplicemente rastremate



ALA EQUIVALENTE

- **stessa Superficie S**
- **stessa apertura b**
- **stessa corda estremità**



For a wing consisting of N panels, the method used to construct an equivalent wing is explained. The parameters used for each wing panel are:

$N_{panel_{l.s.}}$	is the number of panels that make up half of the lifting surface (wing, horizontal tail or canard) or the whole vertical tail. For simplicity, it will be replaced by 'N' in the theory presented below.
c_r	is the root chord length of the i'th panel.
c_t	is the tip chord length of the i'th panel.
Y_r	is the Y-distance of the i'th panel root chord from the fuselage centerline.
Z_r	is the Z-coordinate of the i'th panel root chord leading edge.
X_r	is the X-coordinate of the i'th panel root chord leading edge.
X_t	is the X-coordinate of the i'th panel tip chord leading edge.
ε_t	is the twist angle at the tip of the i'th panel.

The tip chord of the equivalent lifting surface is defined as the tip chord of the N'th panel of the wing planform:

$$c_{t_{l.s.}} = c_{t_N}$$

The root chord of the equivalent lifting surface is solved from:

$$c_{r_{l.s.}} = \left(\frac{c_{r_A} - c_{t_{l.s.}}}{\frac{b_{l.s.}}{2} - Y_{r_1}} \right) Y_{r_1} + c_{r_A}$$

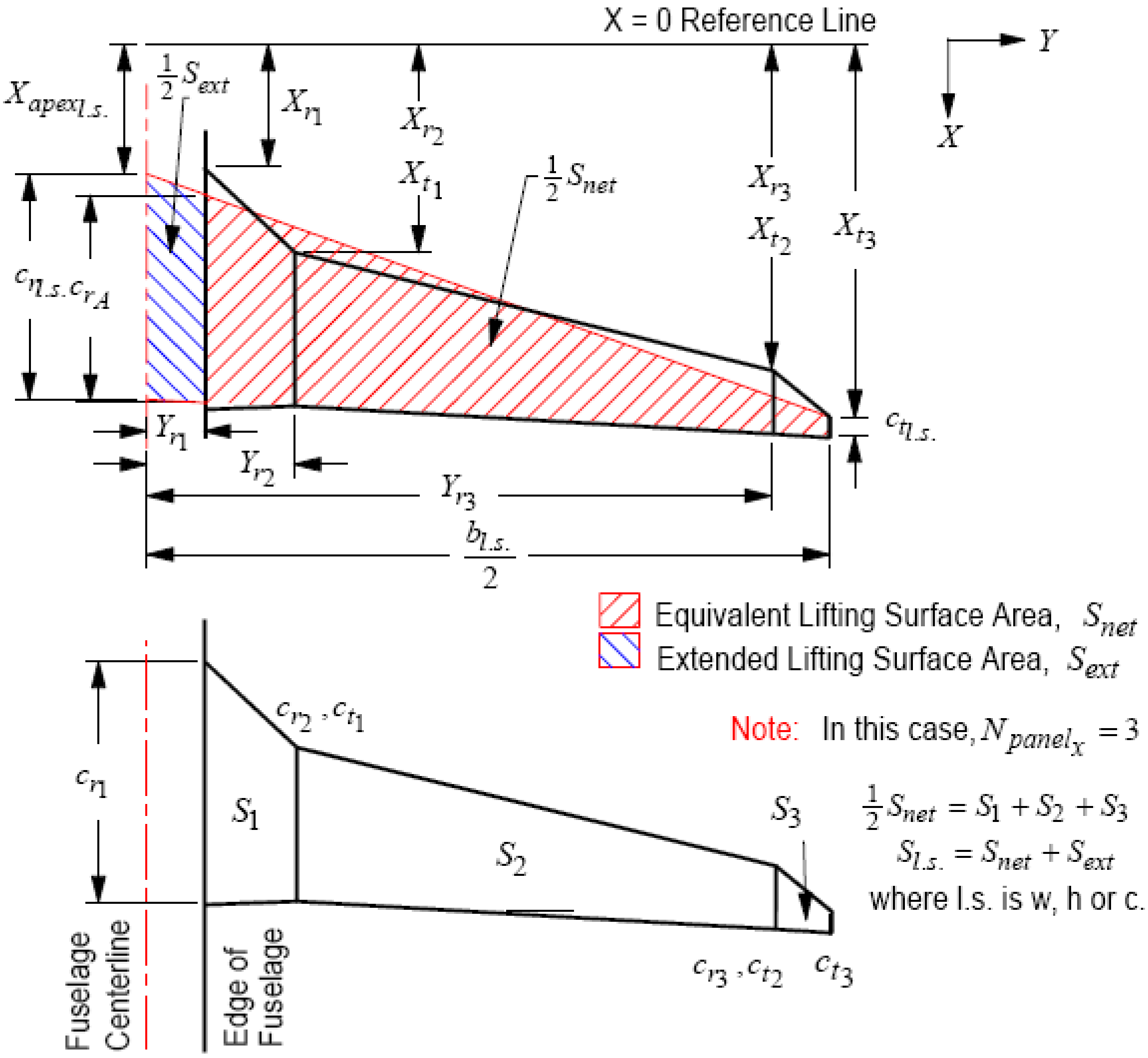
The leading edge sweep angle of the equivalent lifting surface is found from:

$$\Lambda_{LE_{l.s.}} = \tan^{-1} \left\{ \frac{2\left(X_{t_N} - X_{r_1}\right)\left(\frac{b_{l.s.}}{2} - Y_{r_1}\right) - \sum_{i=1}^{N} \left(X_{r_i} + X_{t_i} - 2X_{r_1}\right)\left(Y_{r_{i+1}} - Y_{r_i}\right)}{\left(\frac{b_{l.s.}}{2} - Y_{r_1}\right)^2} \right\}$$

The X-coordinate of the lifting surface apex is determined from:

$$X_{apex_{l.s.}} = X_{t_N} - \frac{b_{l.s.}}{2} \tan \Lambda_{LE_{l.s.}}$$

VEDERE FIGURE PAGINA SEGUENTE



Geometry Parameters for Cranked Wing, Canard Horizontal Tail, or V-Tail

Costruzione grafica per l'ala equivalente e la corda media aerodinamica.

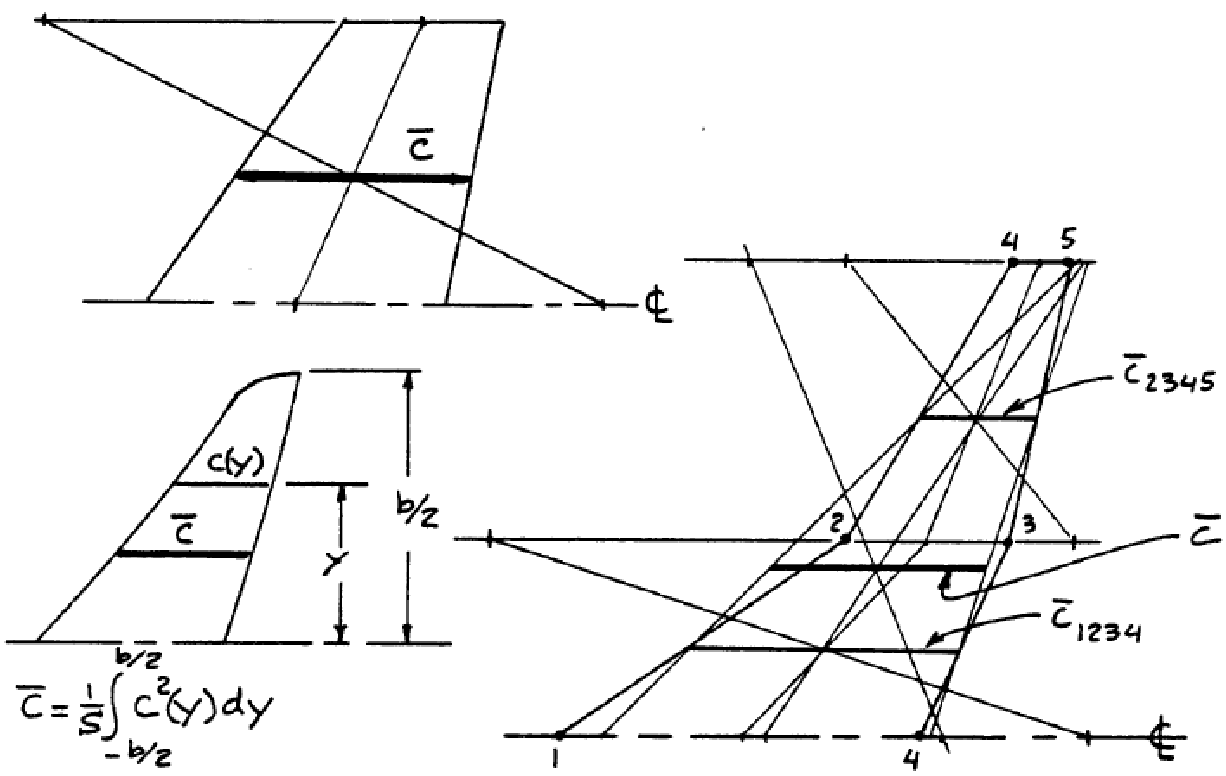
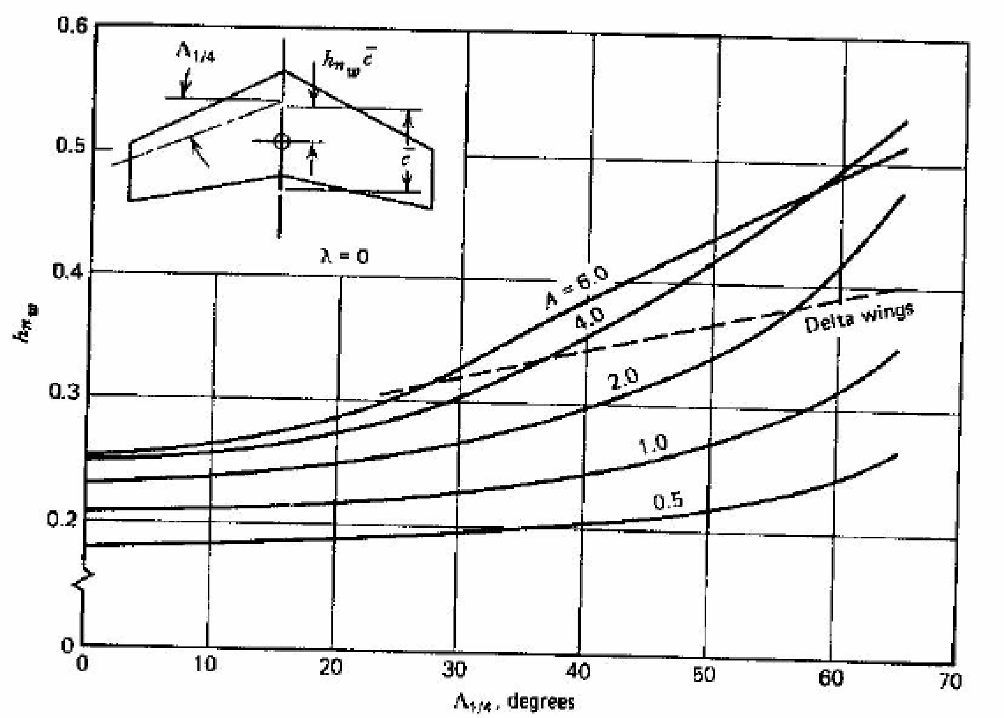
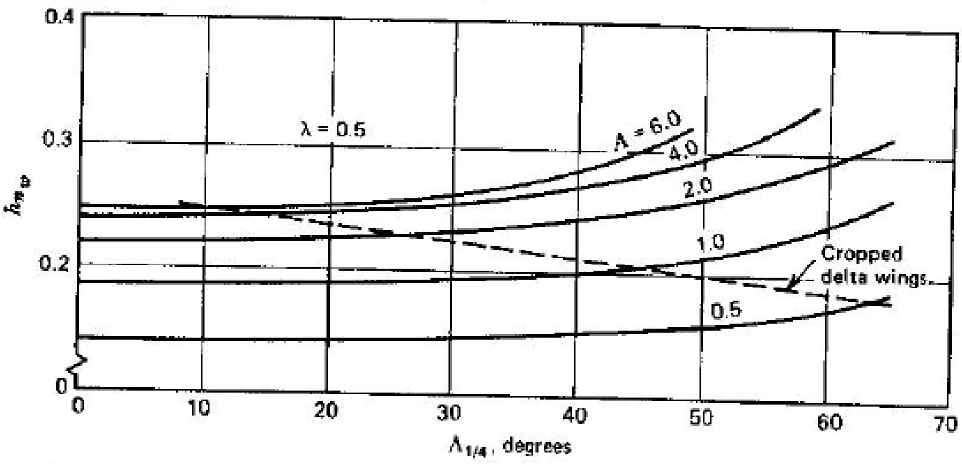
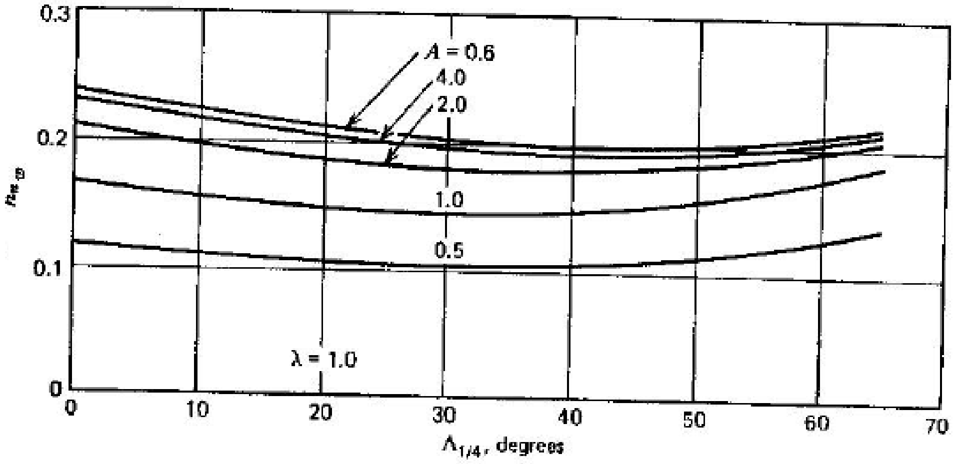


Figure 8.96 Methods for Determining the Wing Mean Geometric Chord

CENTRO AERODINAMICO DELL'ALA







Effetto del Mach sullo spostamento del centro aerodinamico.

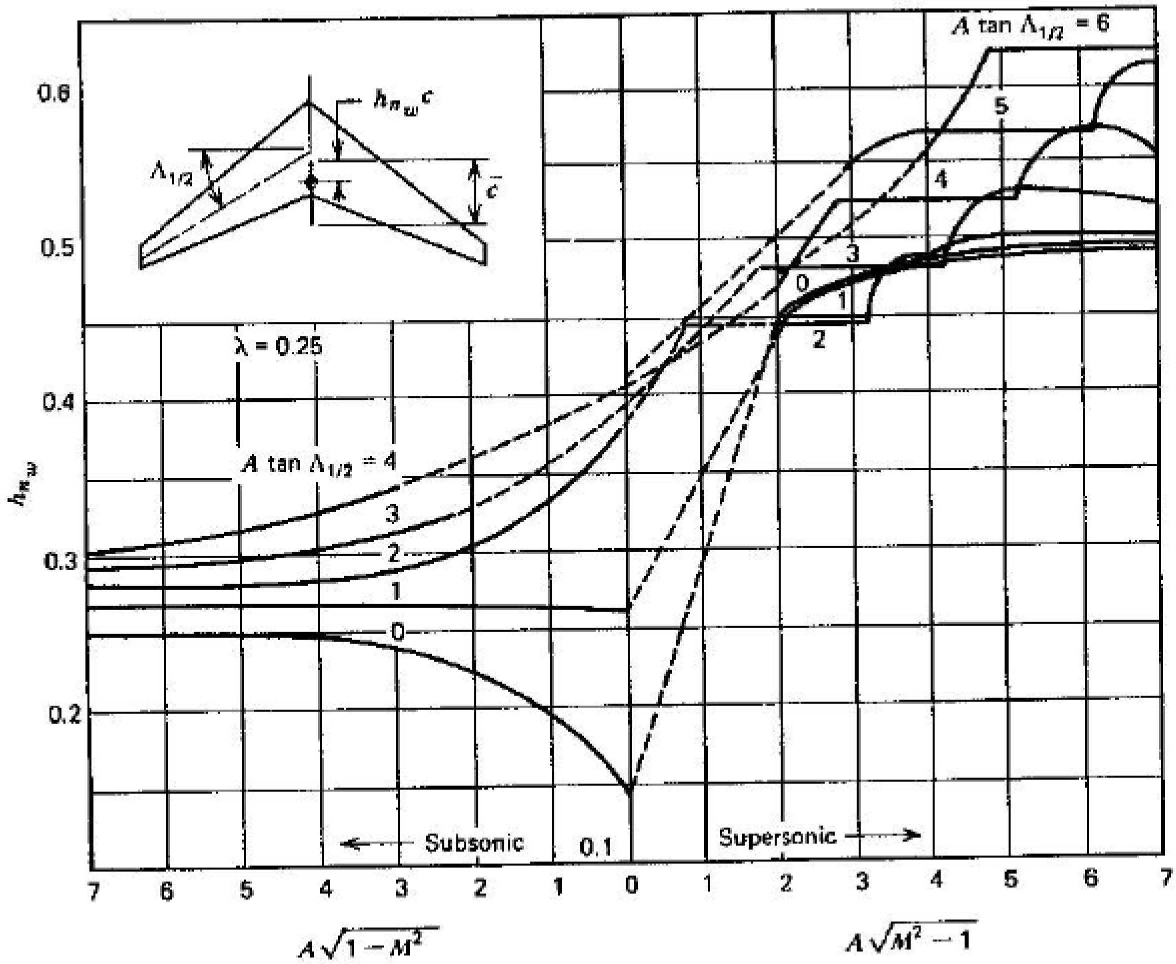


FIG. C.5 (continued)

Centro aerodinamico ala : Roskam.

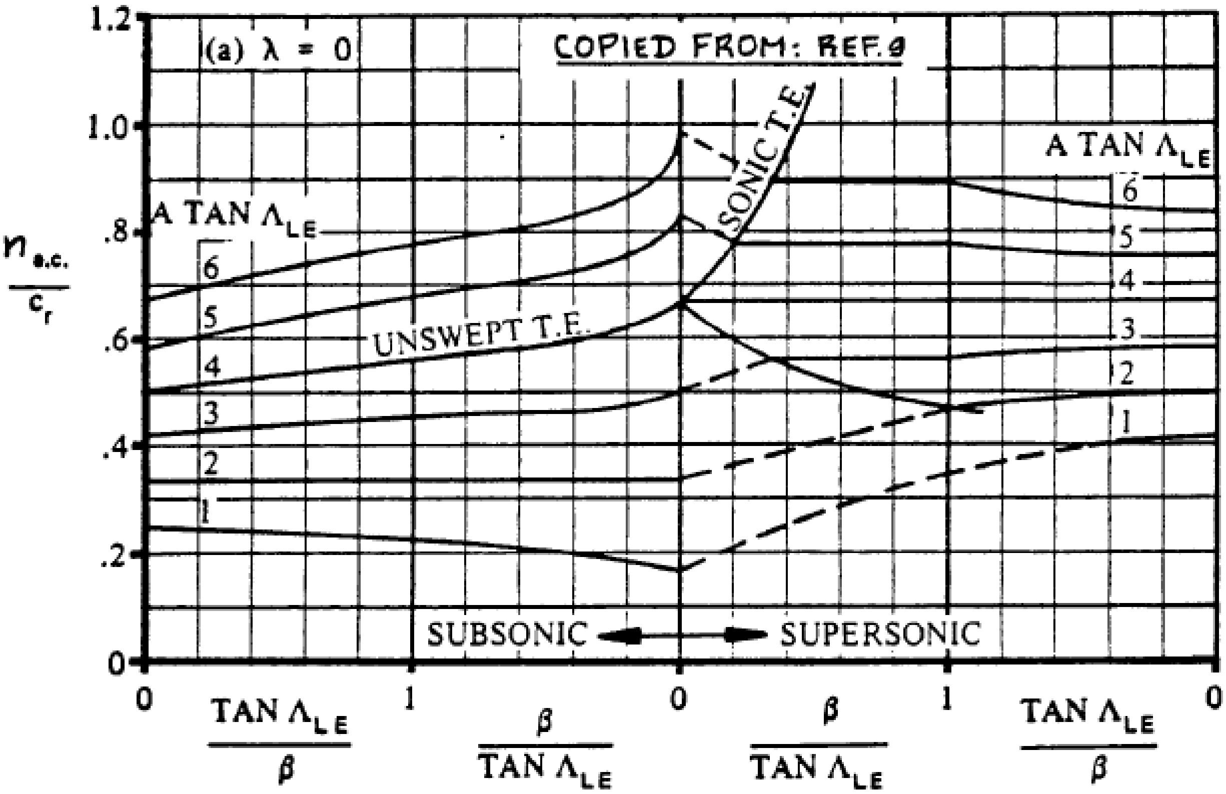
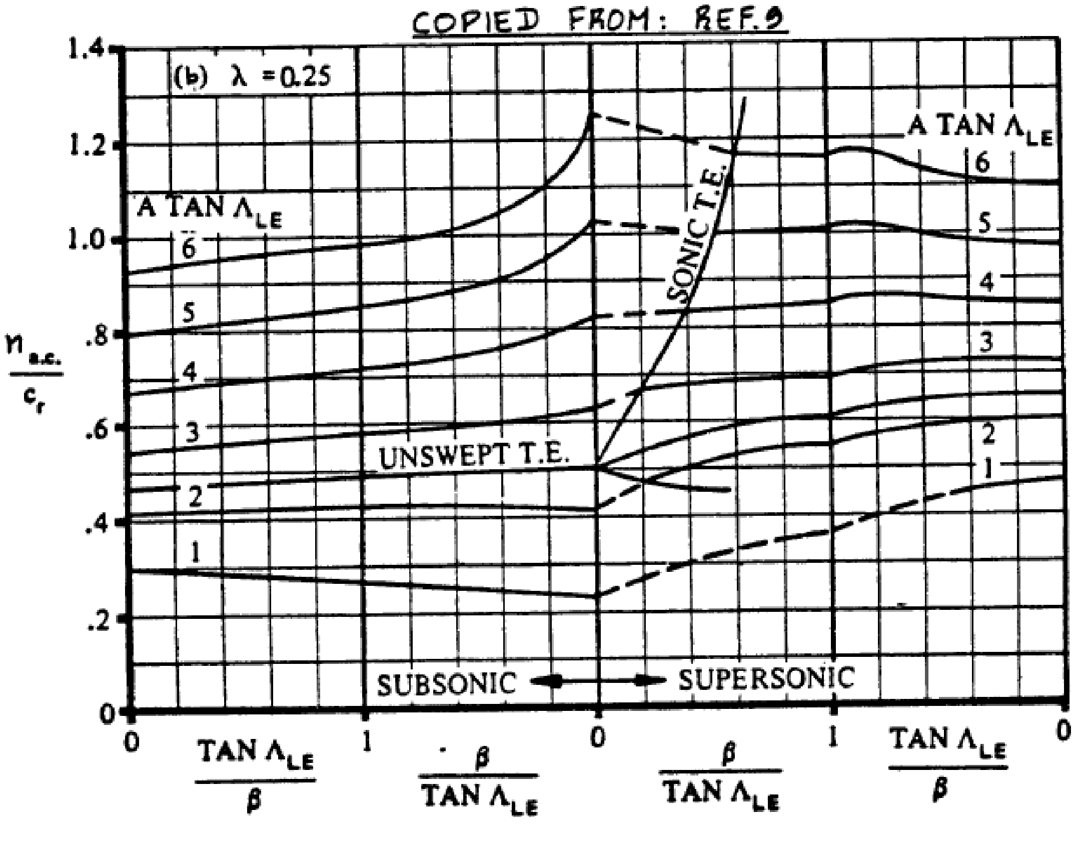
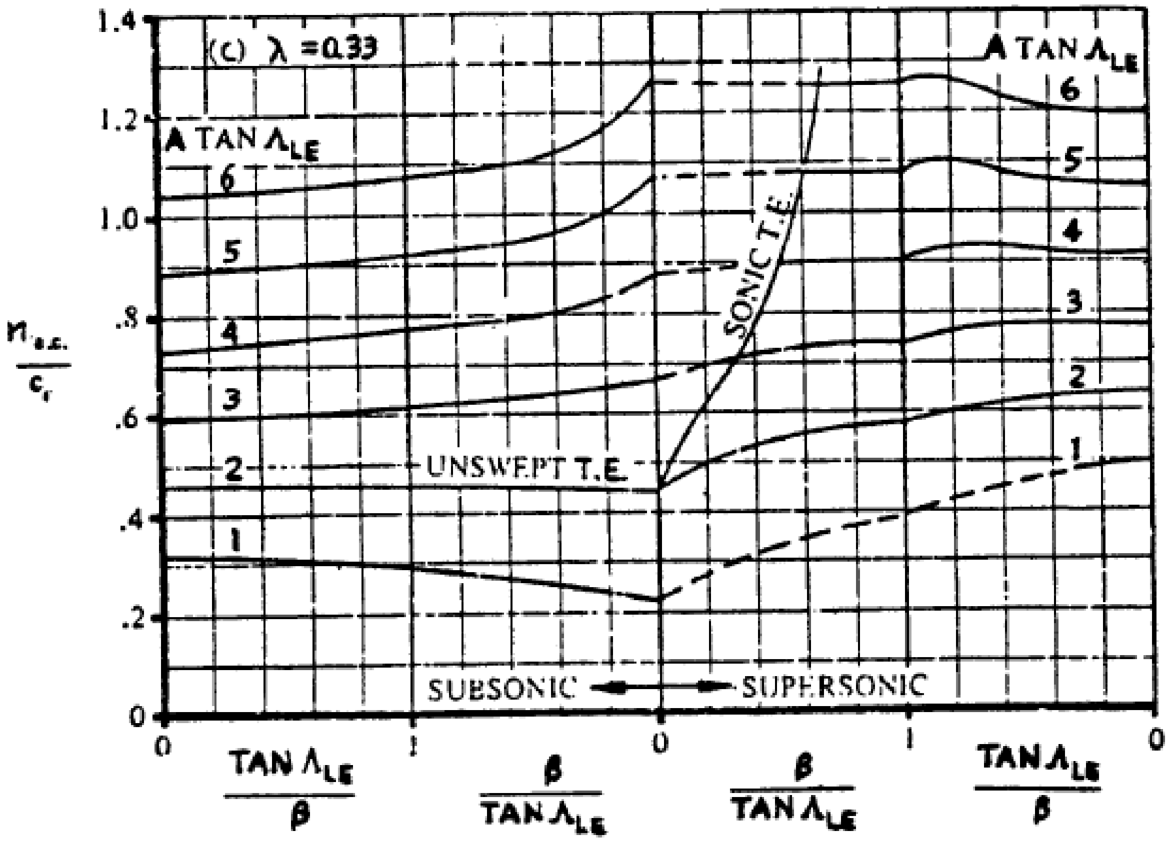


Figure 8.100 Effect of Aspect Ratio, Sweep Angle and Taper Ratio on Wing Aerodynamic Center





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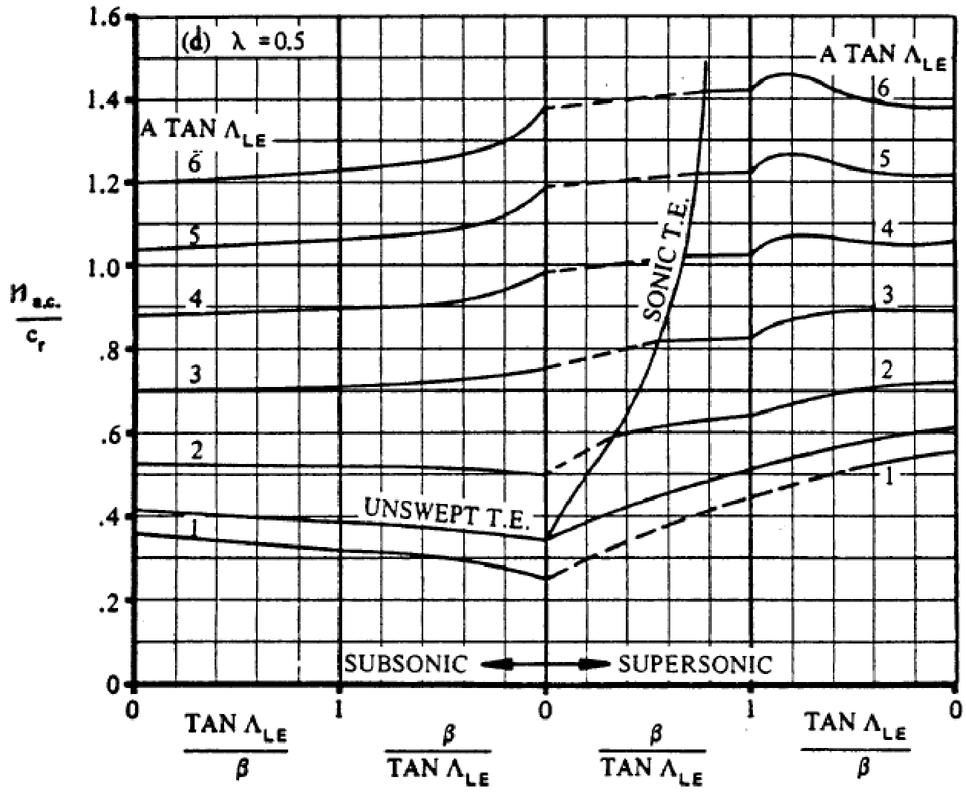
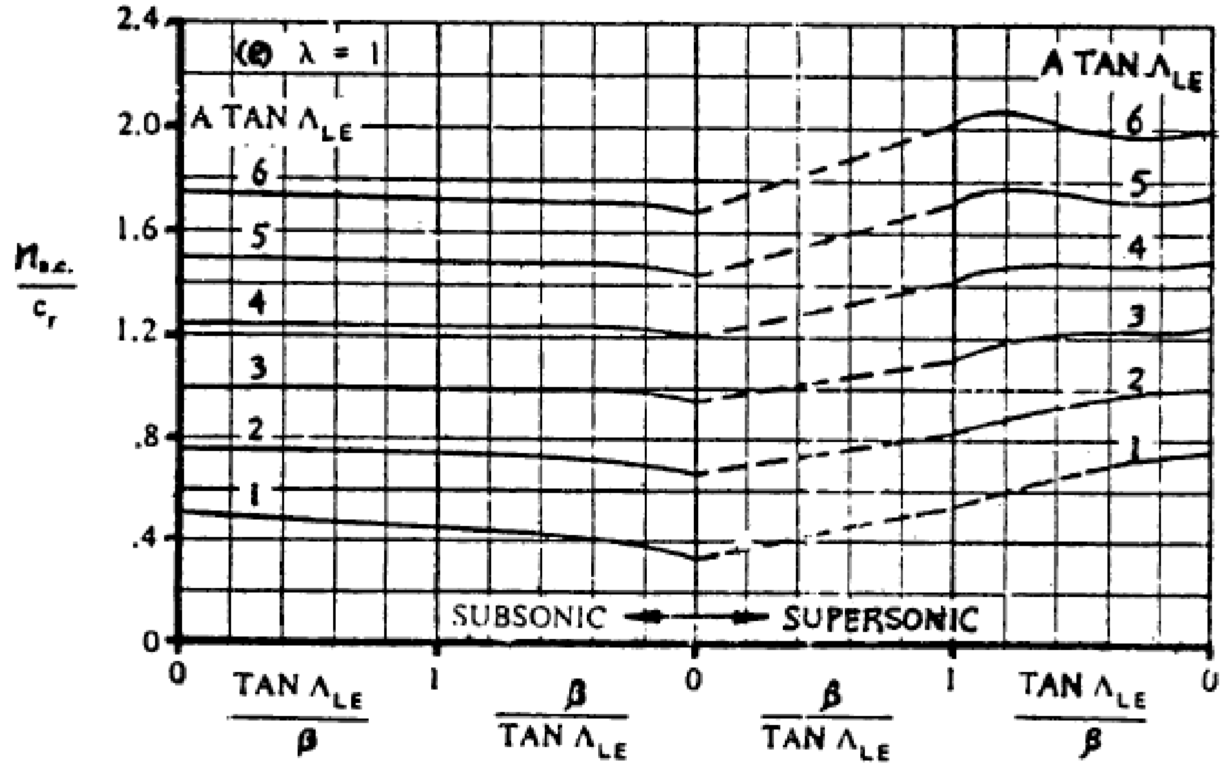
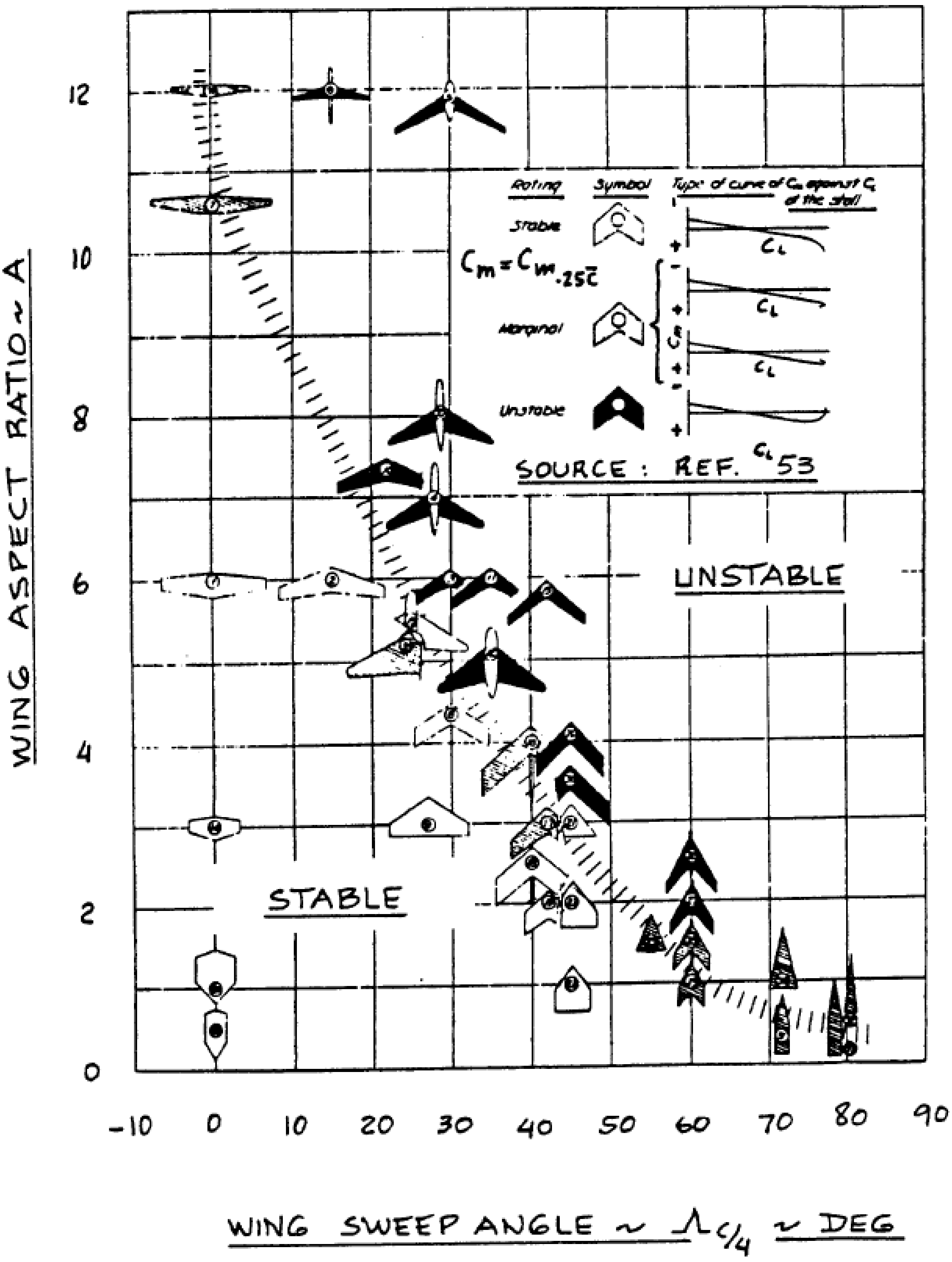



(e) λ = 1
A TAN Λ_{LE}
6
5
4
3
2
1
A TAN Λ_{LE}
6
5
4
3
2
1
$\frac{\bar{x}_{a.c.}}{c_r}$
2.4
2.0
1.6
1.2
.8
.4
0
SUBSONIC
SUPERSONIC
0
1
0
1
0
$\frac{\text{TAN } \Lambda_{LE}}{\beta}$
$\frac{\beta}{\text{TAN } \Lambda_{LE}}$
$\frac{\beta}{\text{TAN } \Lambda_{LE}}$
$\frac{\text{TAN } \Lambda_{LE}}{\beta}$



WING ASPECT RATIO ~ A
0
2
4
6
8
10
12
-10
0
10
20
30
40
50
60
70
80
90
WING SWEEP ANGLE ~ Λc/4 ~ DEG
Rating
Symbol
Stable
Marginal
Unstable
$C_m = C_{m.25\bar{c}}$
SOURCE : REF. 53
UNSTABLE
STABLE

8.2.3.1 Wing zero-lift pitching moment coefficient: $C_{m_{o_w}}$

Subsonic:

$$C_{m_{o_w}} = \{(A\cos^2\Lambda_{c/4})/(A + 2\cos\Lambda_{c/4})\}(c_{m_{o_r}} + c_{m_{o_t}})/2 + + (\Delta C_{m_o}/\varepsilon_t)\varepsilon_t \quad (8.70)$$

where: $c_{m_{o_r}}$ and $c_{m_{o_t}}$ are the zero-lift pitching moment coefficients of the root and tip airfoils respectively. These follow from 8.2.1.1.

$\Delta C_{m_o}/\varepsilon_t$ is found from Figure 8.98.

Note: This method applies to conventional straight tapered wings with sweep angles below 45 degrees and aspect ratios above 2.5. For other wing types, Reference 9 should be consulted.

Transonic:

Up to the critical Mach number, use:

$$C_{m_{o_{w_{at\ M}}}} = C_{m_{o_{w_{atM=0}}}} \{(C_{m_o})_M/(C_{m_o})_{M=0}\} \quad (8.71)$$

where: $\{(C_{m_o})_M/(C_{m_o})_{M=0}\}$ is given in Figure 8.99.

$C_{m_{o_{w_{at\ M=0}}}}$ is found from Eqn.(8.70).

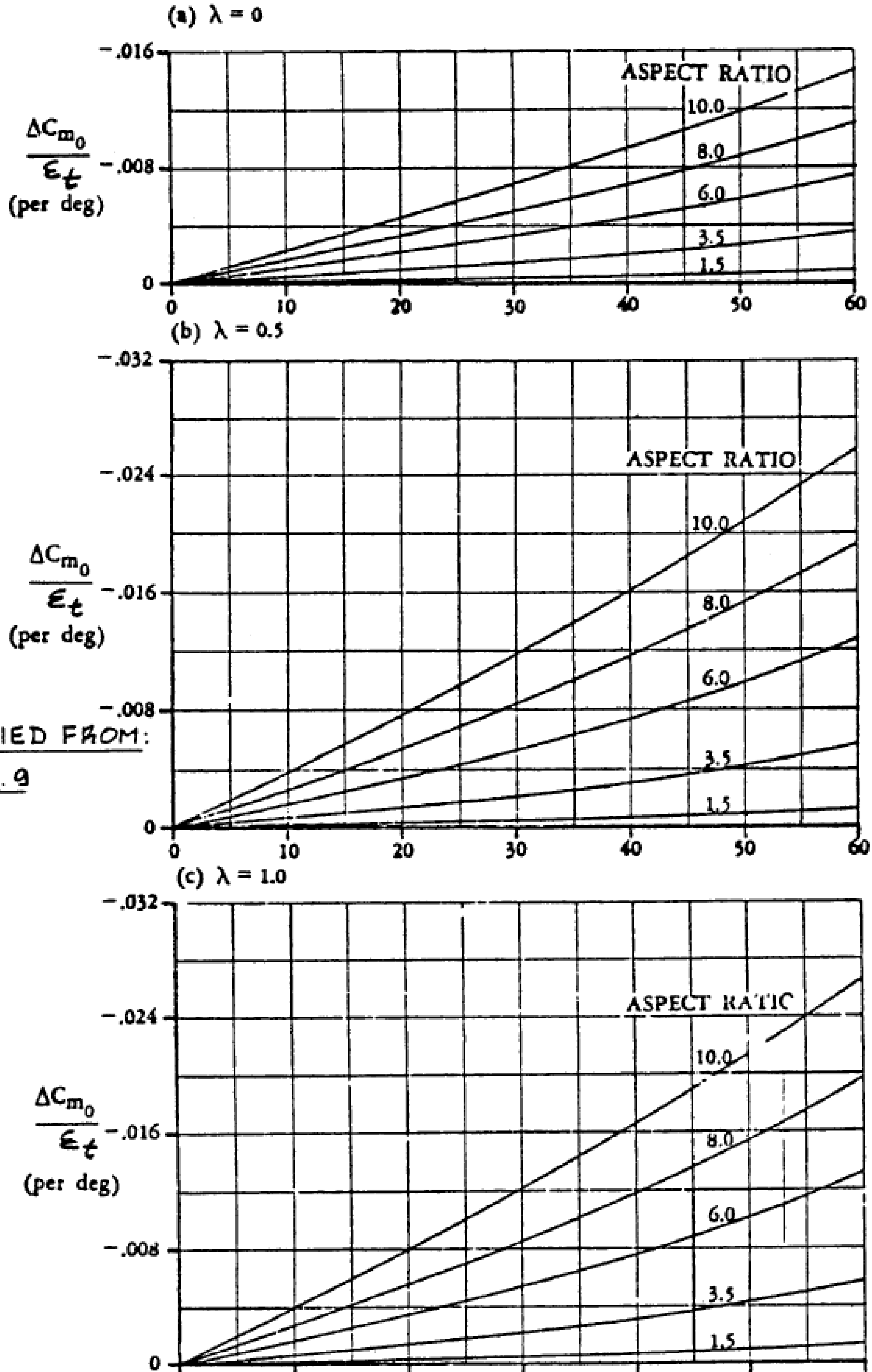


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Figure 8.98 Effect of Linear Twist on Wing Zero-lift Pitching Moment Coefficient

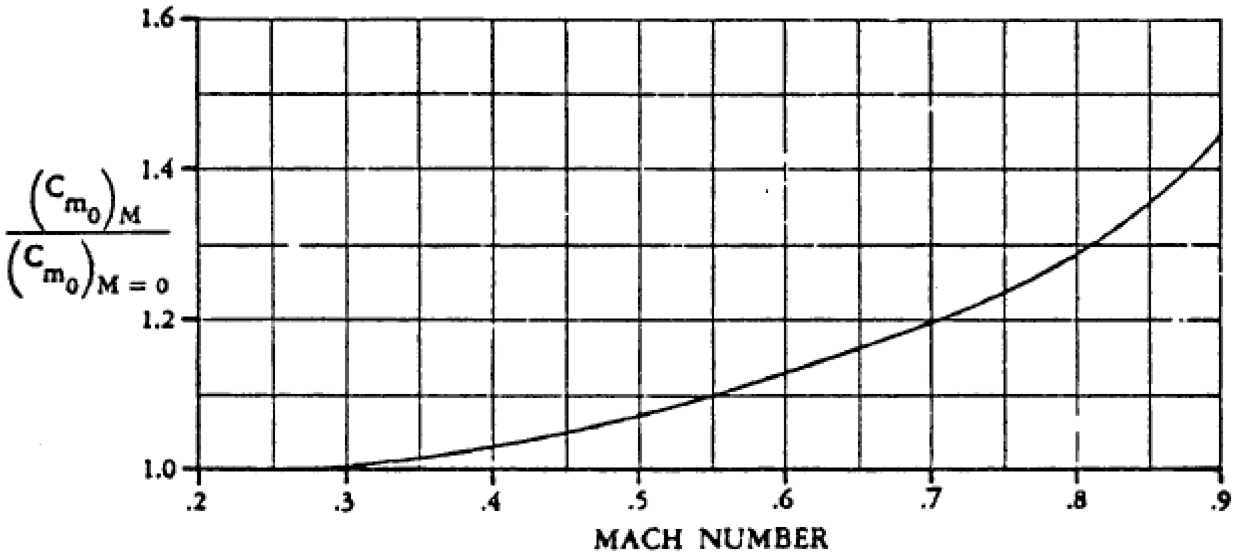

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Figure 8.99 Effect of Mach Number on Wing Zero-lift Pitching Moment Coefficient