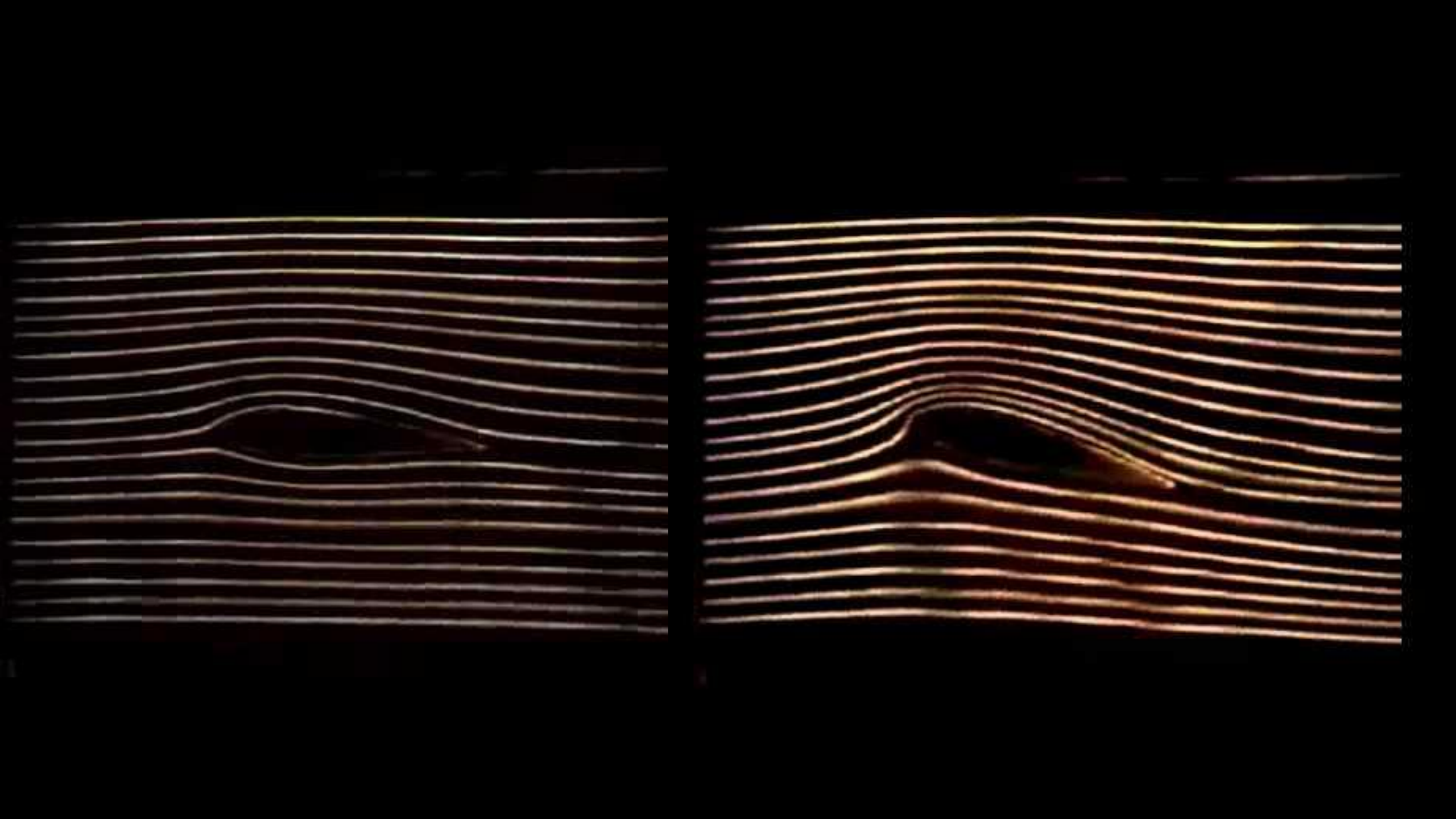
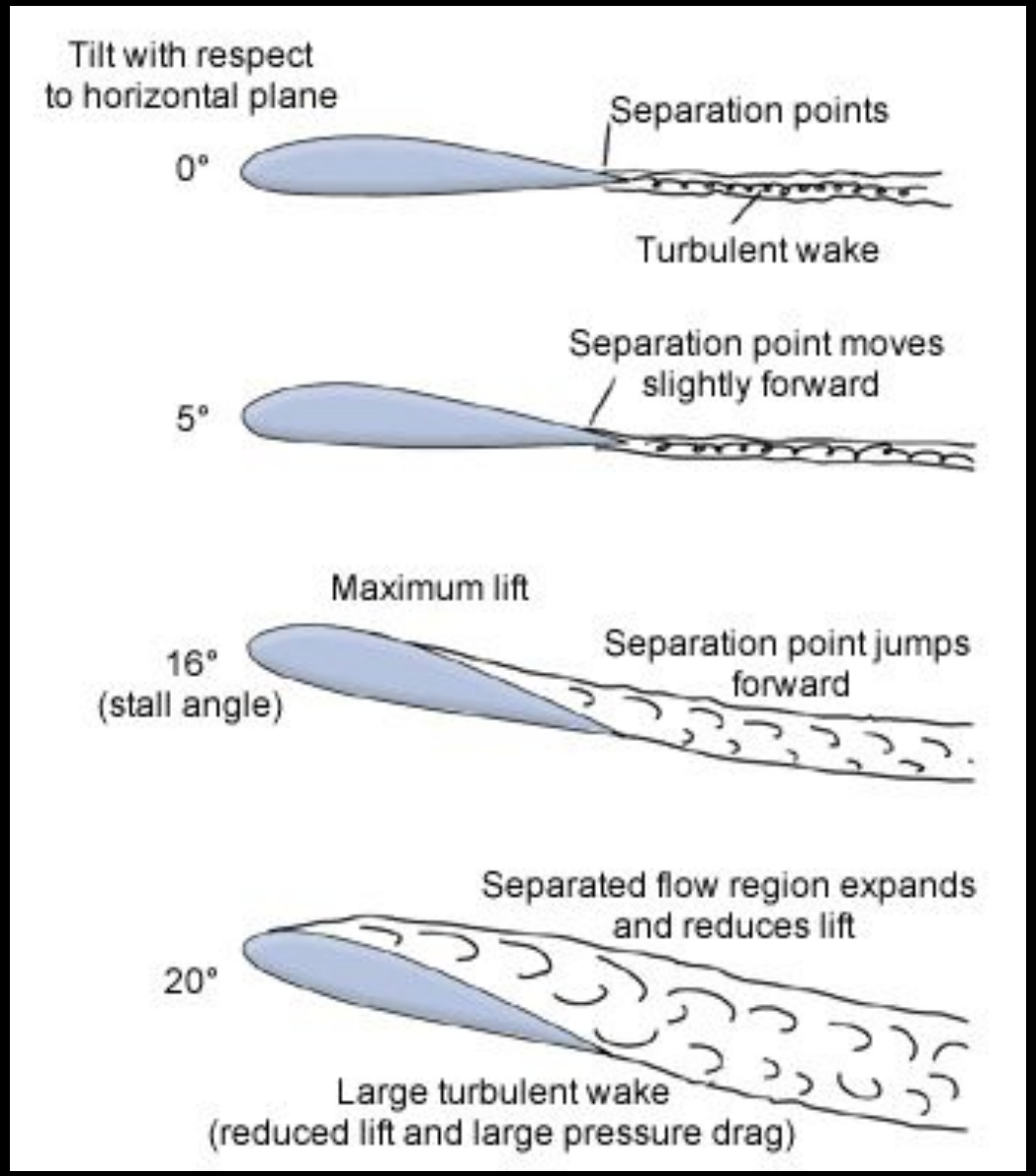
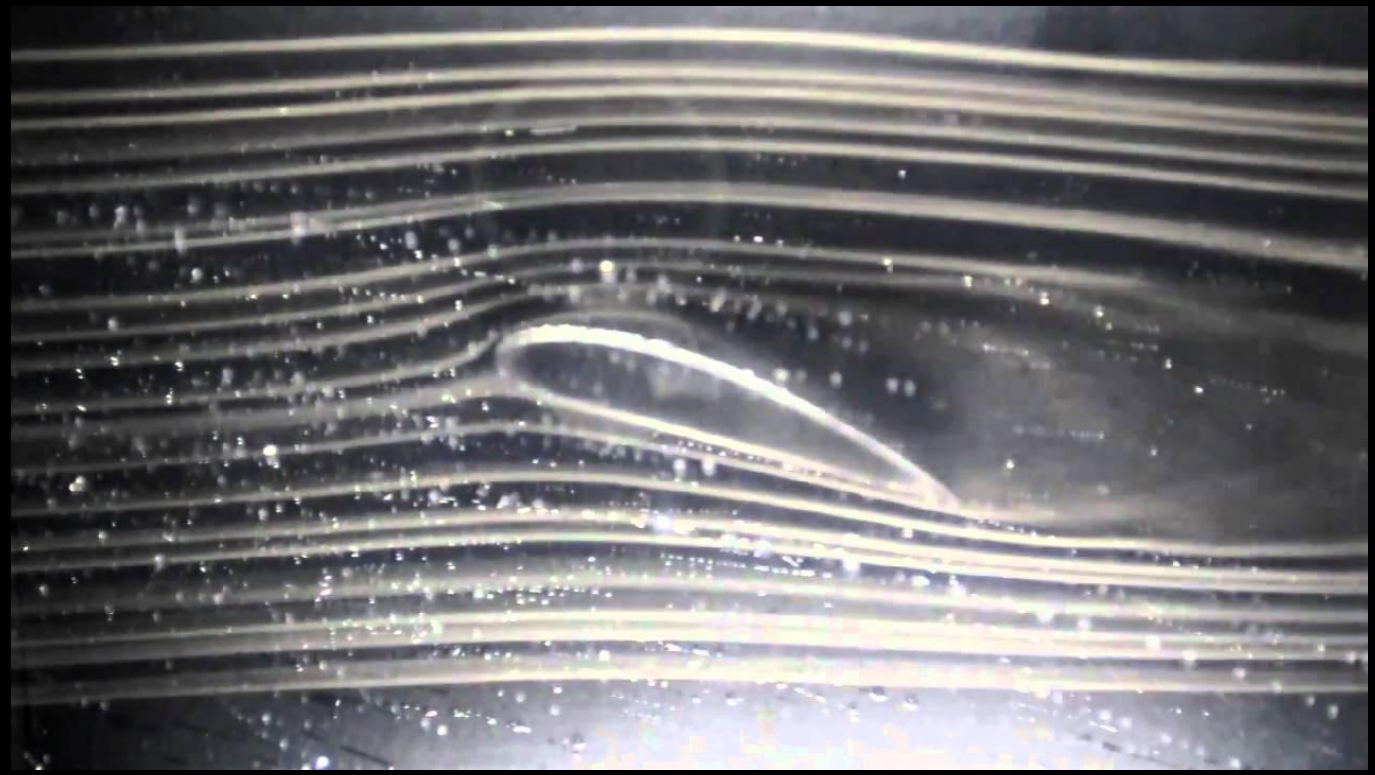
AERODINÂMICA 2D







https://www.youtube.com/watch?v=WFcW5-1NP60

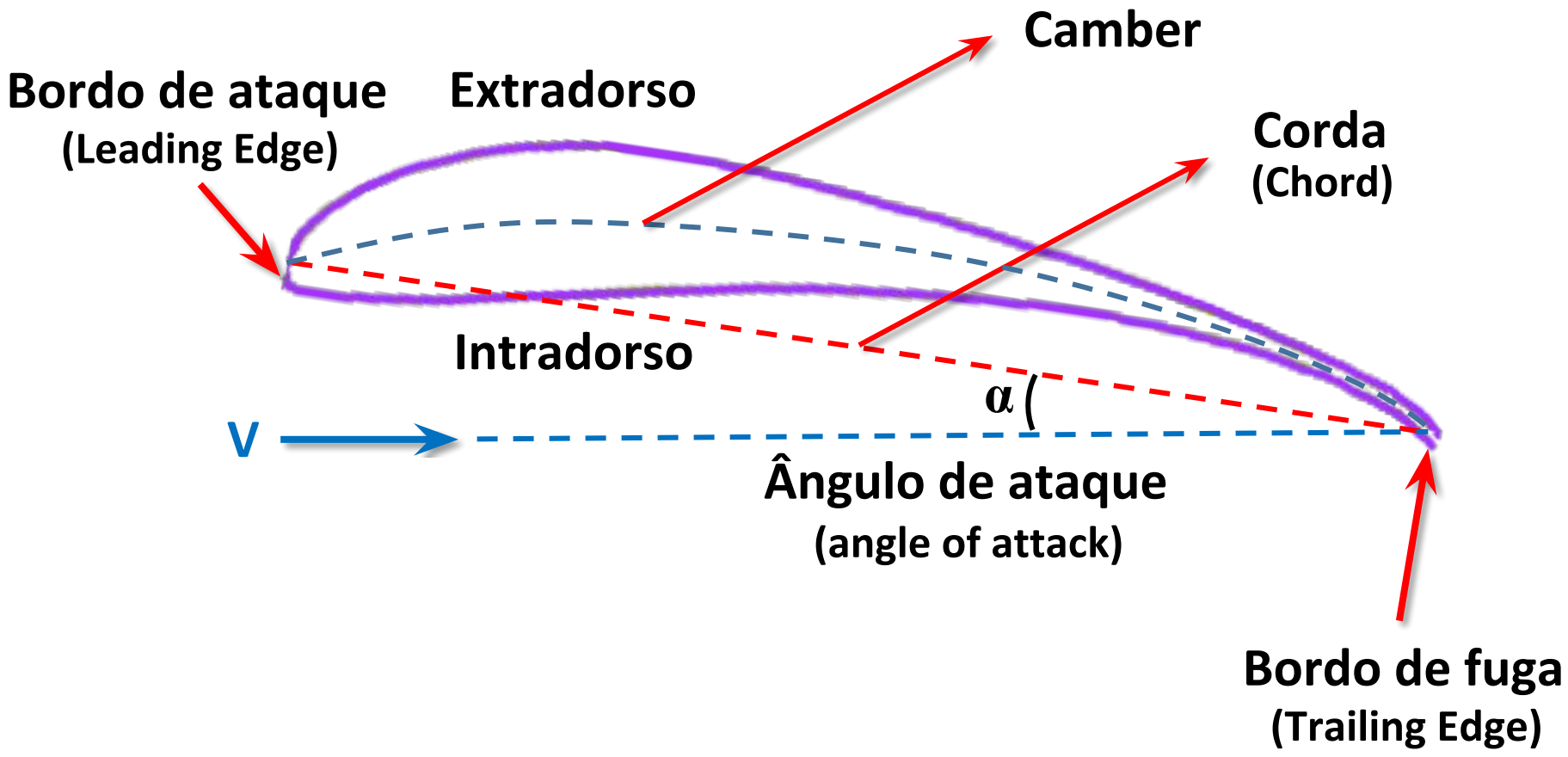
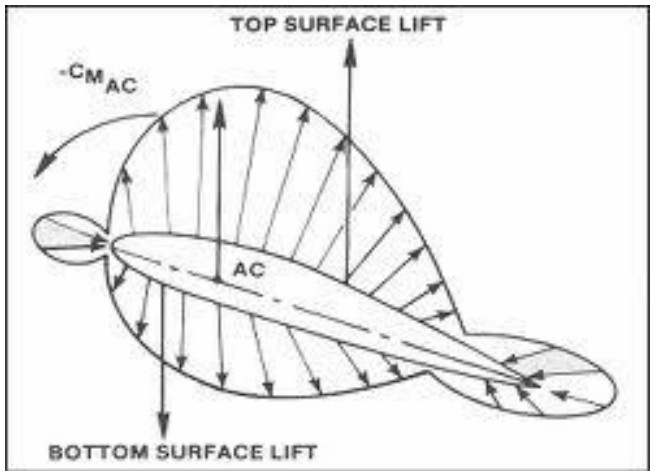
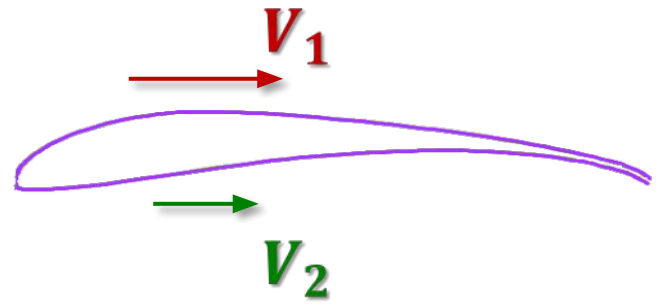

Camber
Bordo de ataque
(Leading Edge)
Extradorso
Corda
(Chord)
Intradorso
α
V
Ângulo de ataque
(angle of attack)
Bordo de fuga
(Trailing Edge)

Fig. 4.6 Typical airfoils.

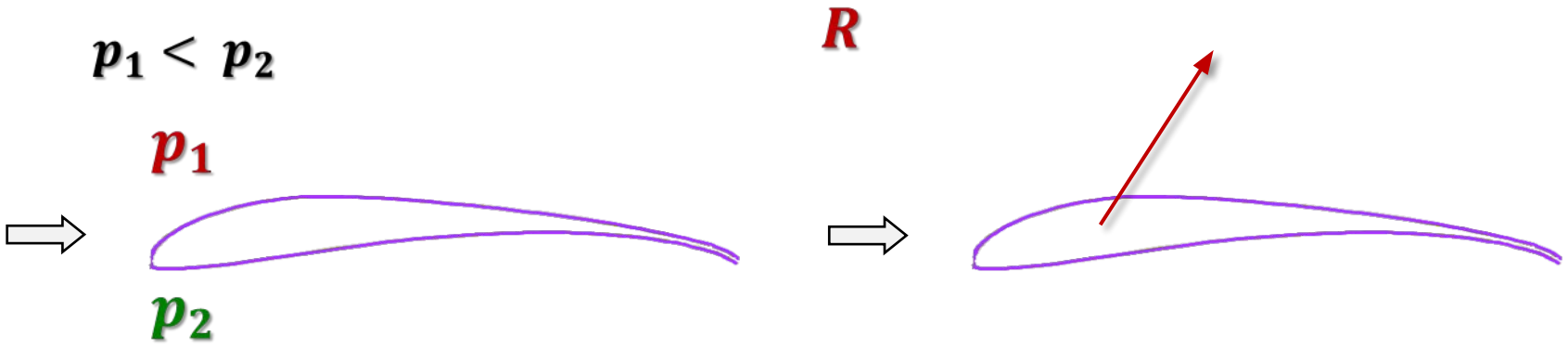
Aerodinâmica



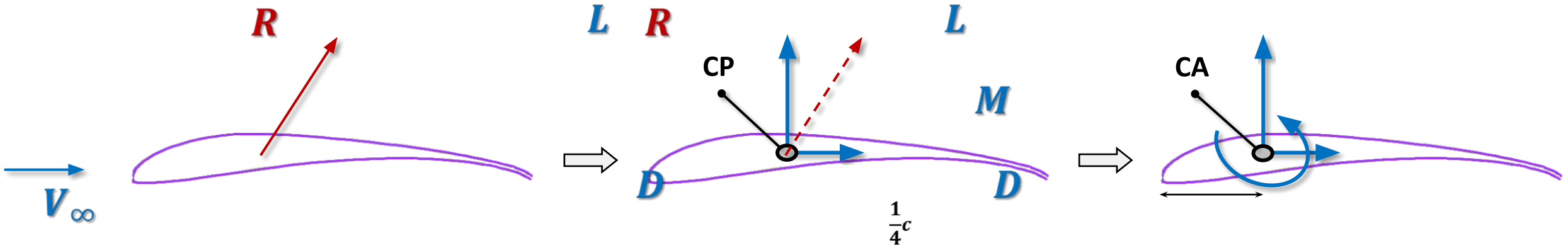
$V_1 > V_2$



$p_1 < p_2$



Aerodinâmica



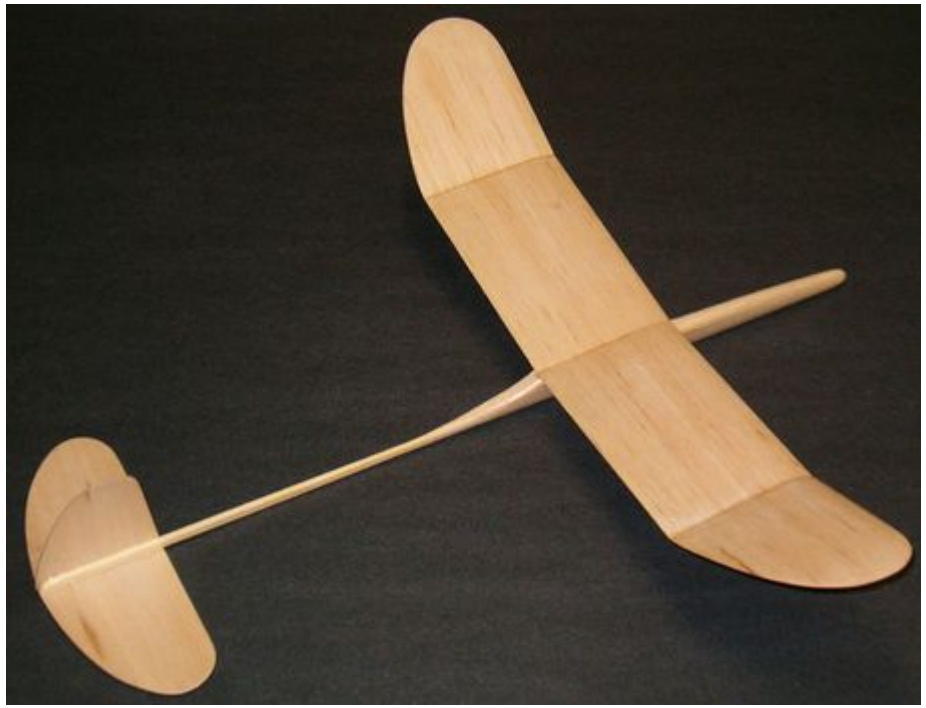
Sustentação (Lift)	L	**Força perpendicular ao escoamento**
Arrasto (Drag)	D	**Força paralela ao escoamento**
Momento de arfagem (Pitching moment)	M	

EMBRAER 195E1

Dados:

Massa = 50000 kg
Mach = 0.75
Altitude de 38.000 pés

Estime o valor da força sustentação em <u>um voo de cruzeiro nivelado</u>



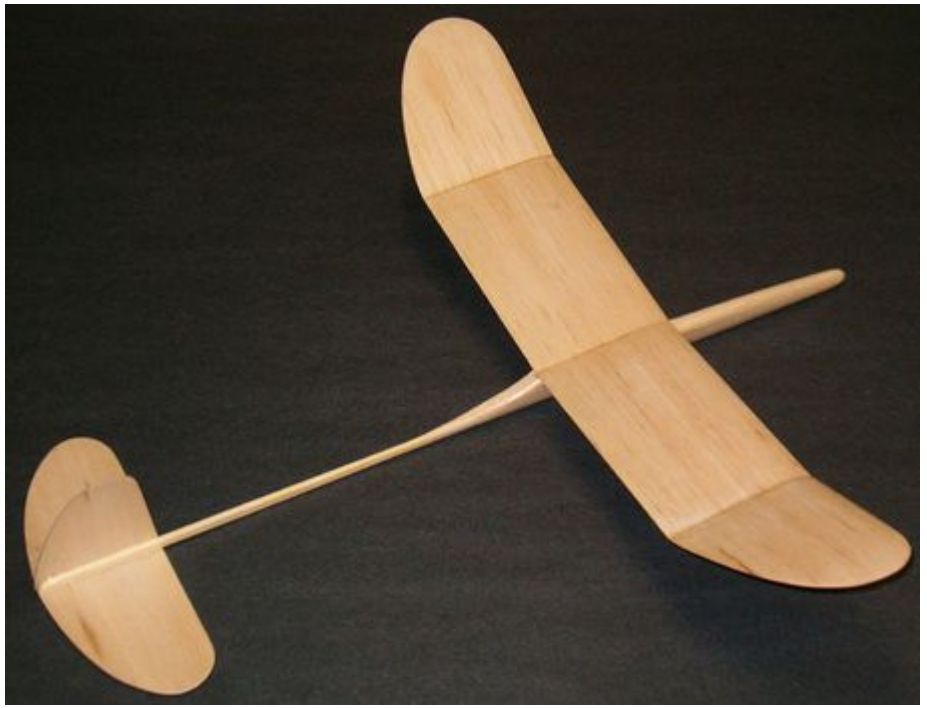
Planador

Dados:

Massa = 50 g
Velocidade = 3 m/s
Altitude de 0 pés

Estime o valor da força sustentação em <u>um voo planado</u>

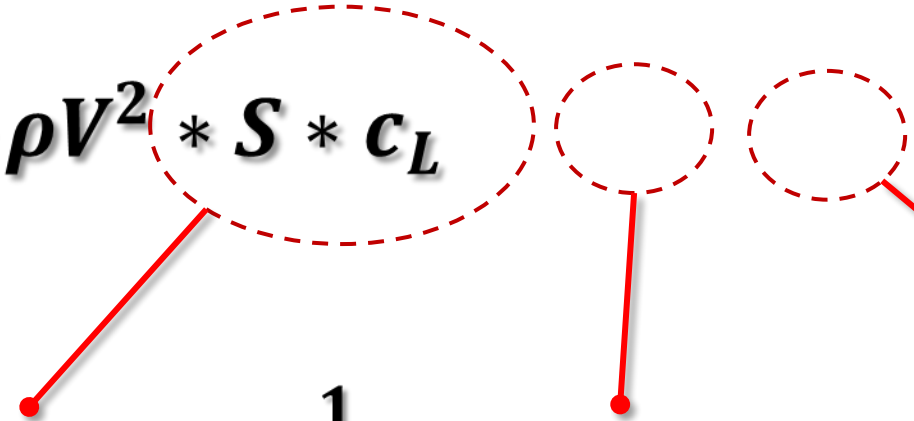
L = 490500 N



L = 0,4905 N

Aerodinâmica

$$L = \frac{1}{2}\rho V^2 * S * c_L$$



Pressão dinâmica

Área da superfície

Coeficiente de sustentação

$$L = \frac{1}{2}\rho V^2 \, S \, c_L$$

$$D = \frac{1}{2}\rho V^2 \, S \, c_D$$

$$M = \frac{1}{2}\rho V^2 \, S \, c \, c_m$$

$$L = \frac{1}{2}\rho V^2 \, S \, c_L$$

$$D = \frac{1}{2}\rho V^2 \, S \, c_D$$

$$(Força = Pressão * Área)$$

Análogo para D e M

$$M = \frac{1}{2}\rho V^2 \, S \, c \, c_m$$

Aerodinâmica

$$c_L = \frac{L}{q * S_{wing}} = \frac{L}{\frac{1}{2} * \rho * V^2 * S_{wing}}$$

Pressão dinâmica

Área da superfície

$$L = \frac{1}{2}\rho V^2 \, S \, c_L$$

$$D = \frac{1}{2}\rho V^2 \, S \, c_D$$

$$(Força = Pressão * Área)$$

$$M = \frac{1}{2}\rho V^2 \, S \, c \, c_m$$

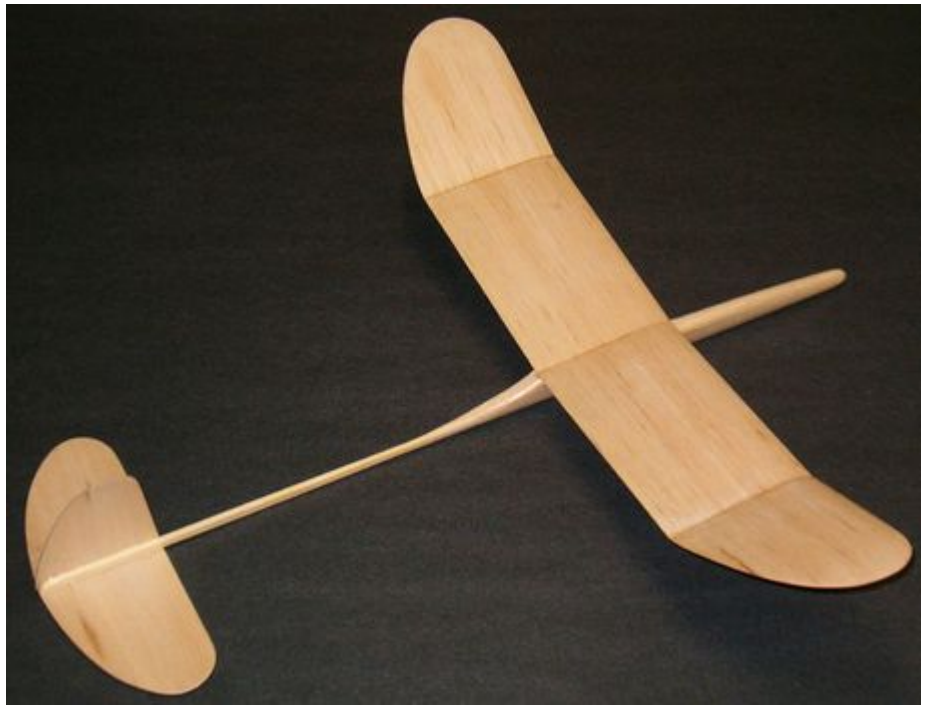
Análogo para D e M

EMBRAER 195E1

Dados:

Massa = 50000 kg
Mach = 0.75 (c = 295,069 m/s)
Altitude de 38.000 pés
$\rho = 0.332\ kg/m^3$
c = 295,069 m/s
$Sw = 92.53\ m^2$

Estime o valor do CL em <u>um voo de cruzeiro nivelado</u>



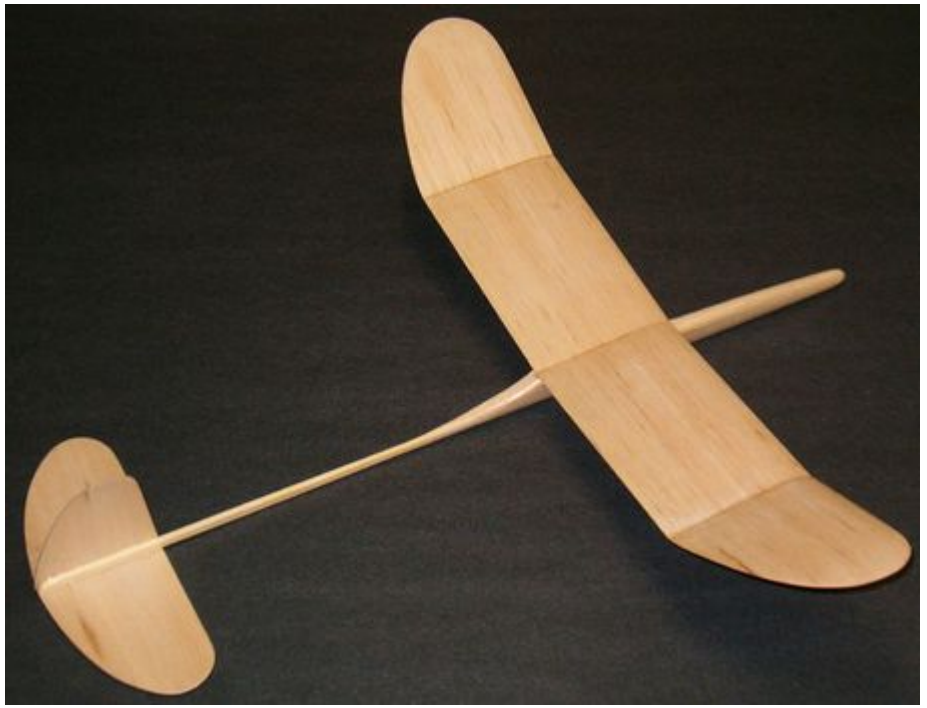
Planador

Dados:

Massa = 50 g
Velocidade = 3 m/s
Altitude de 0 pés
Sw = 0,1 m^2

Estime o valor do CL em um voo planado

L = 490500 N
CL = 0,65



L = 0,4905 N
CL = 0,88

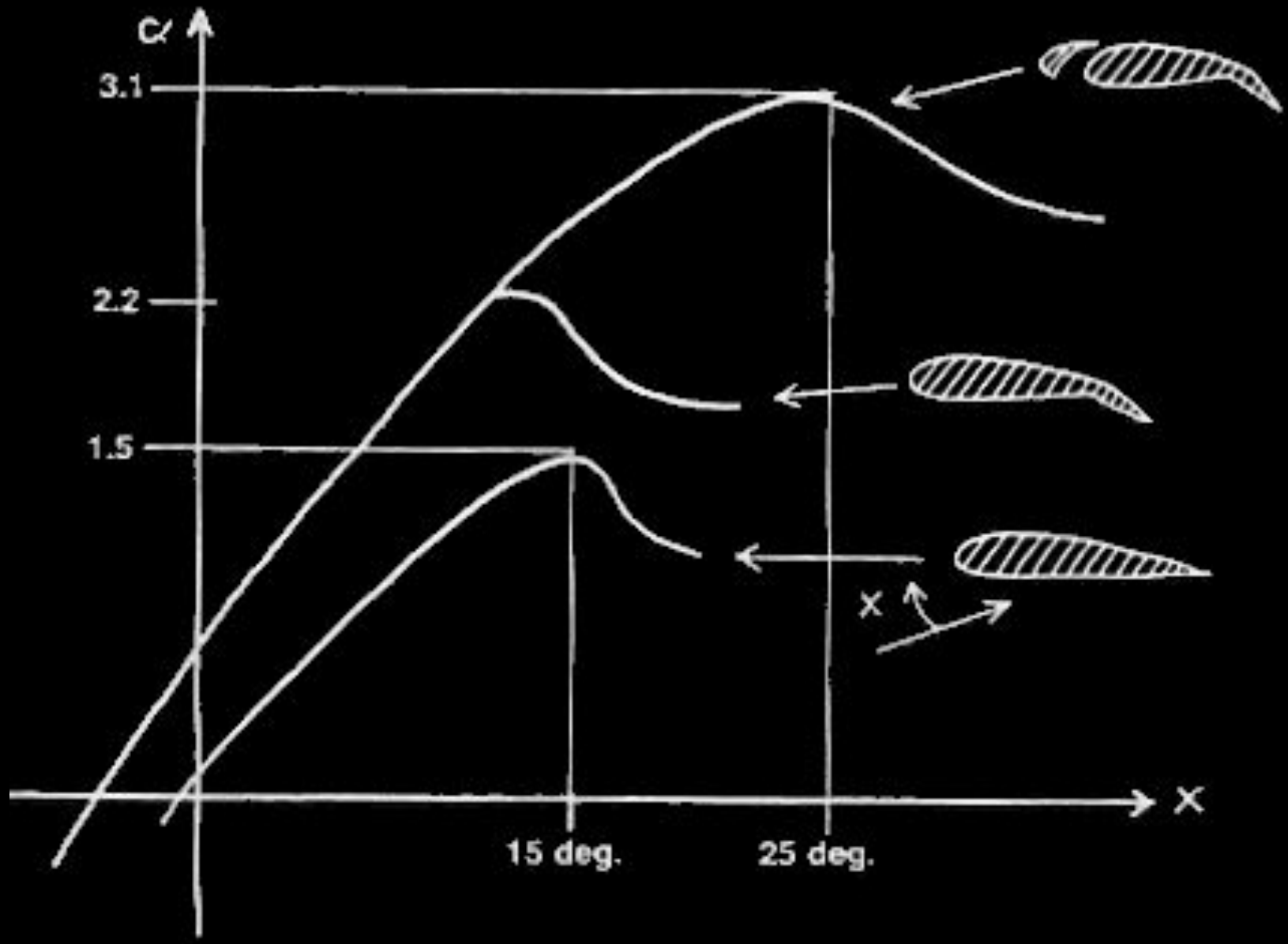
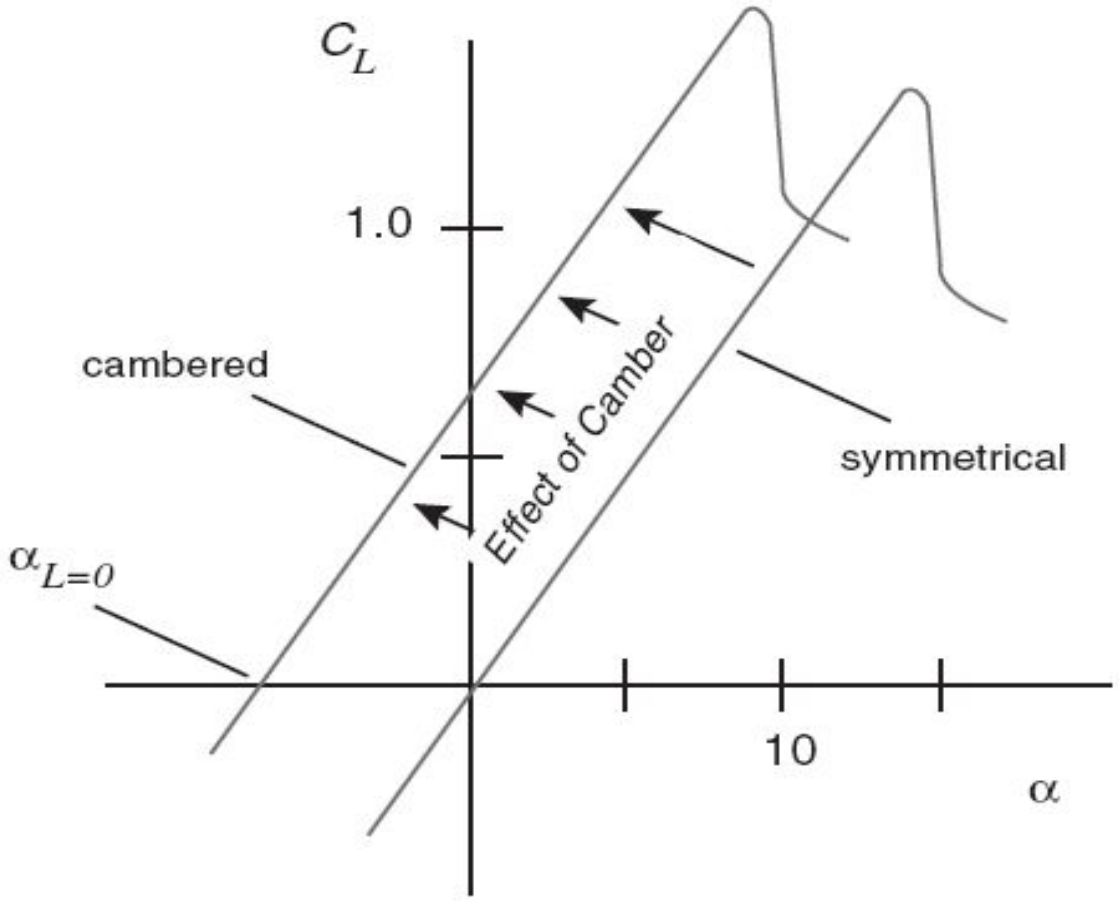
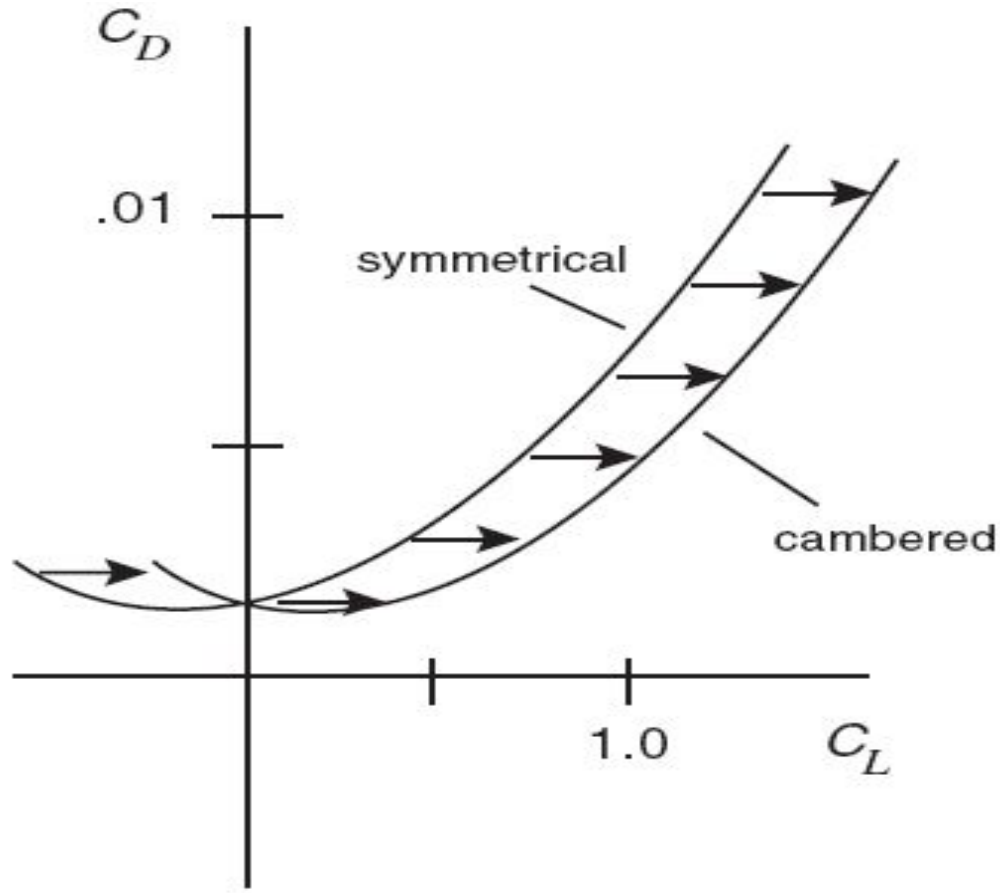
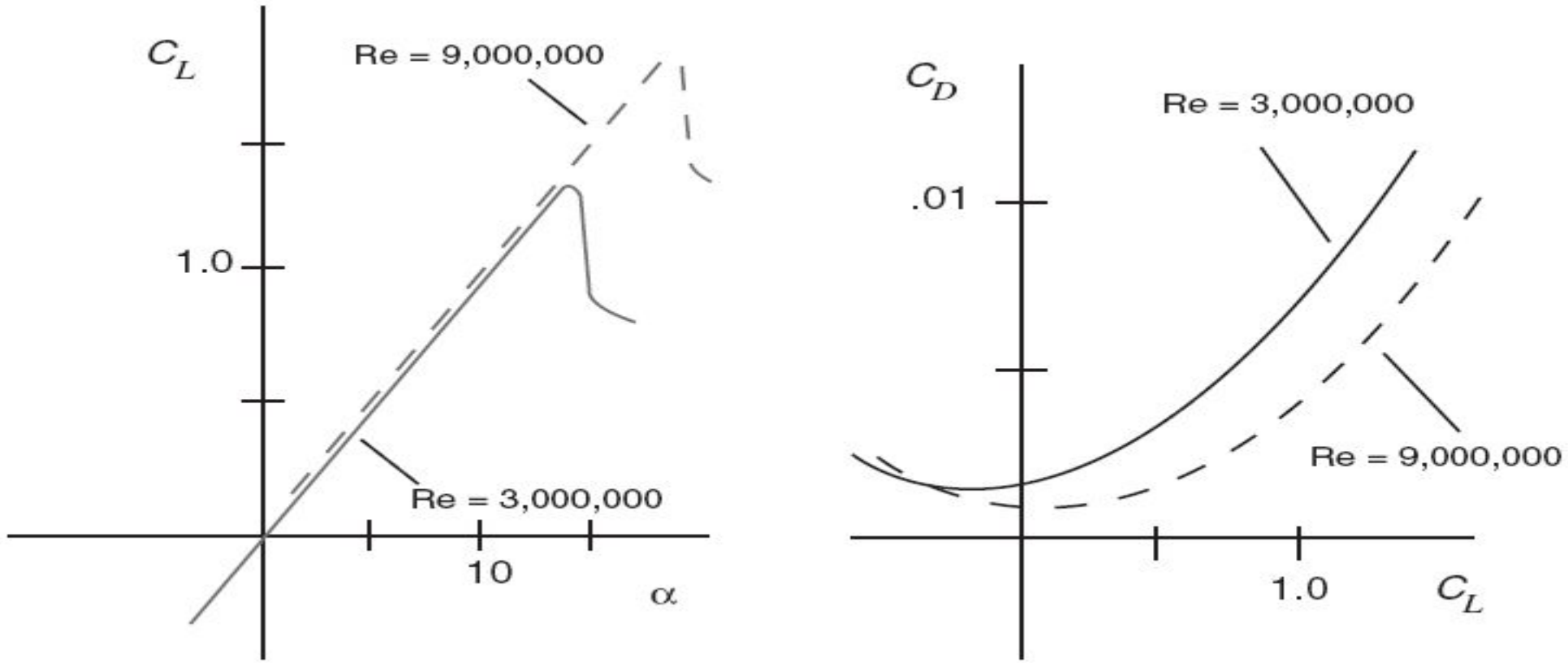


Figure 1

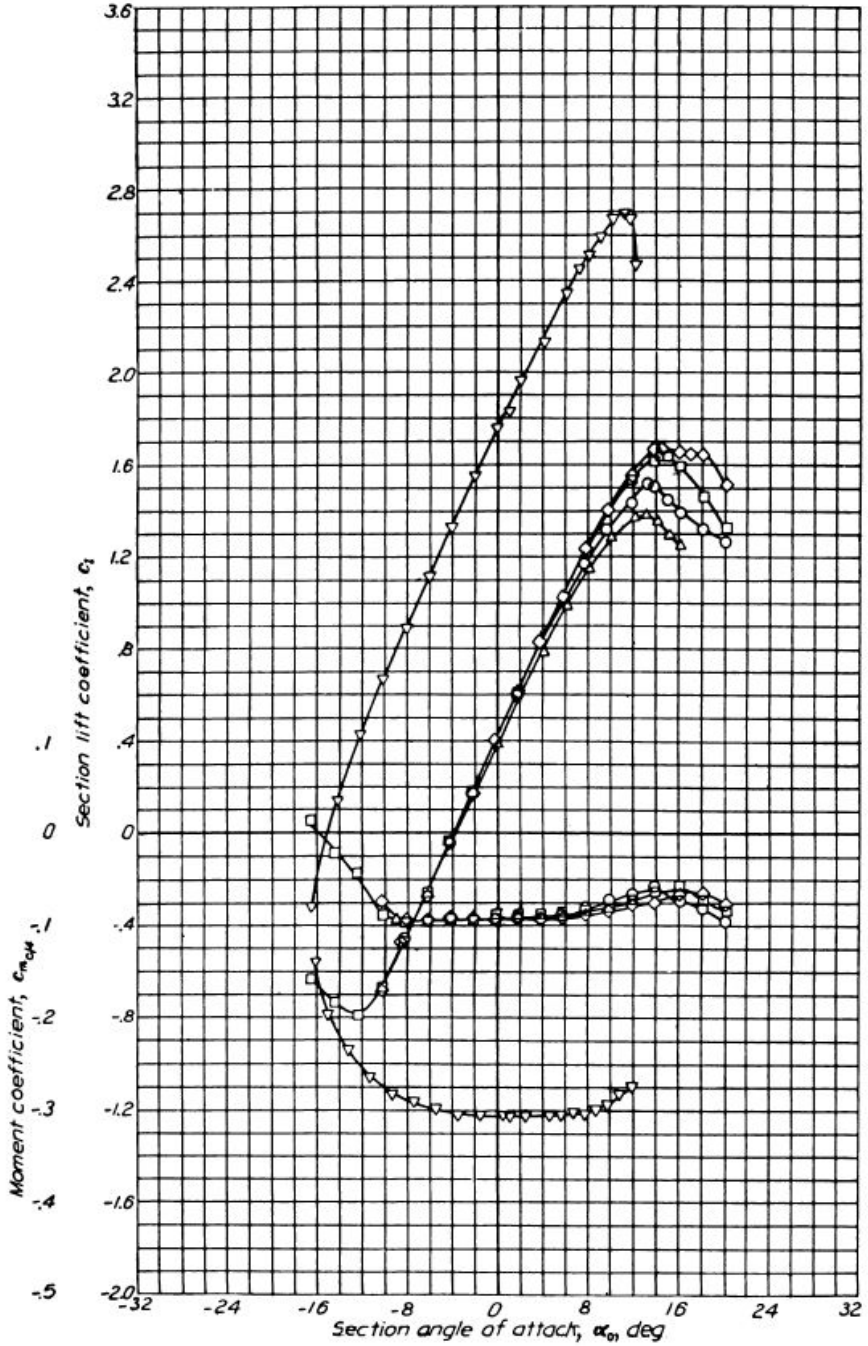
https://www.youtube.com/watch?v=Xr7ykVwxqBM


C_L
1.0
cambered
Effect of Camber
symmetrical
$\alpha_{L=0}$
10
α

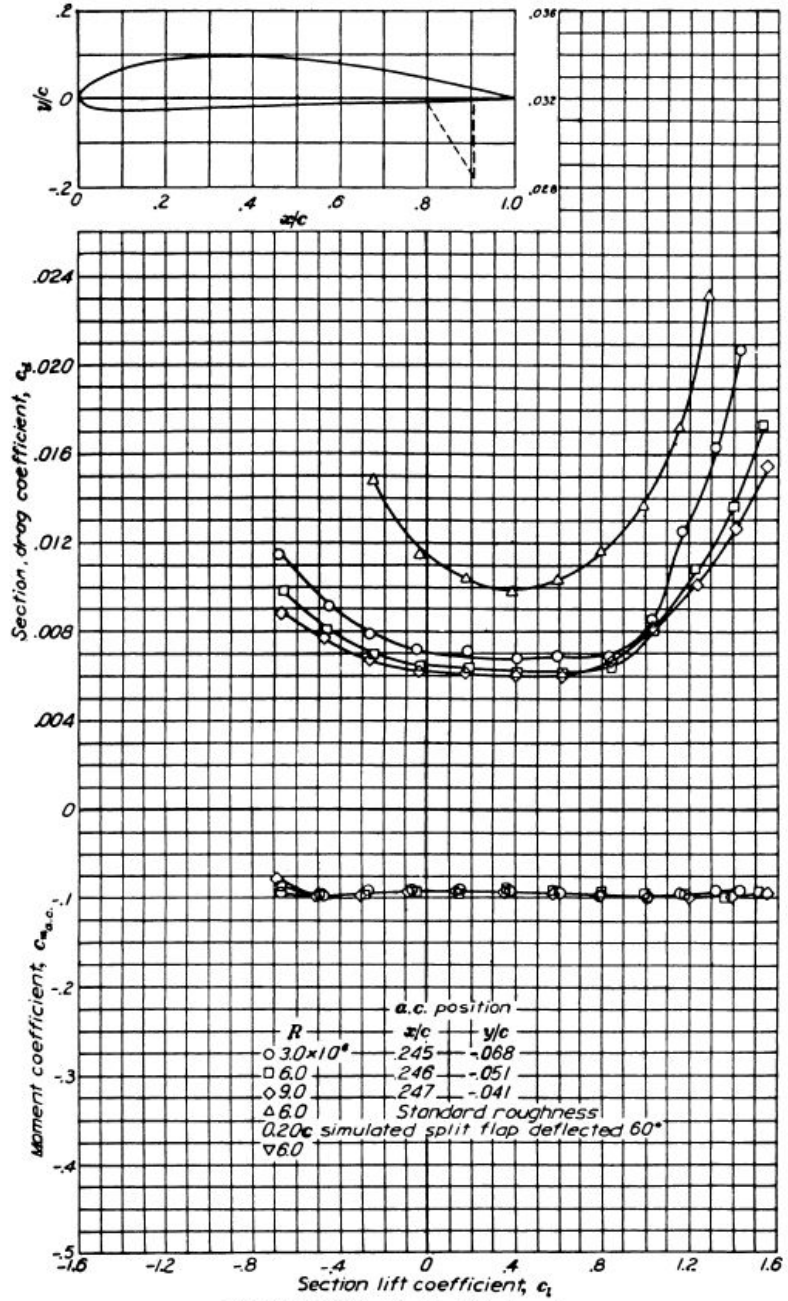

C_D
.01
symmetrical
cambered
1.0
C_L



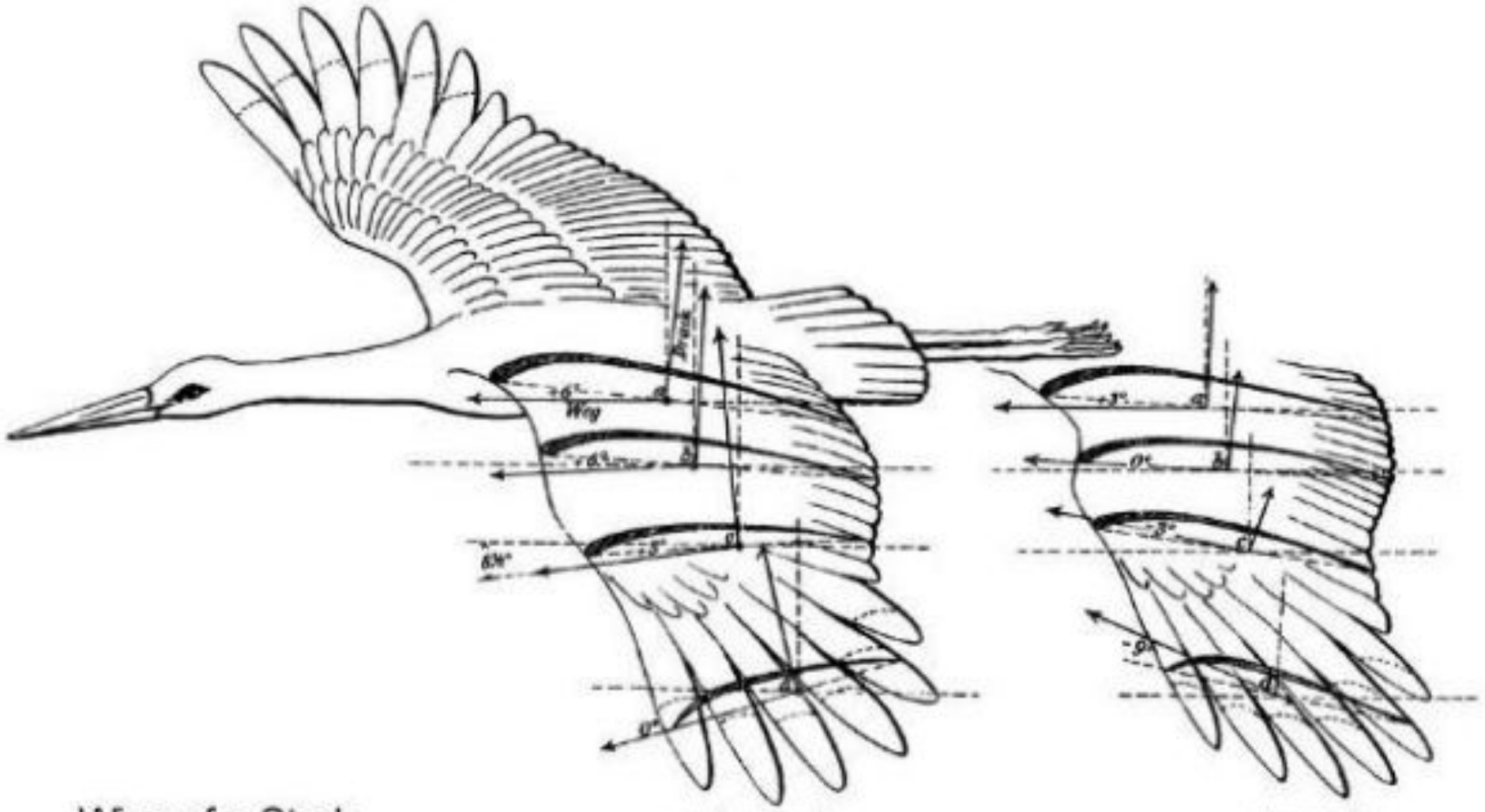
Efeito do NRey



NACA 4412 Wing Section



NACA 4412 Wing Section (*Continued*)



Wing of a Stork

at downstroke

at upstroke

Otto Lilienthal: Der Vogelflug als Grundlage der Fliegekunst.
Publishing house R. Gärtner, Berlin 1889, reprinting, publishing company Oldenbourg Munich 1943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