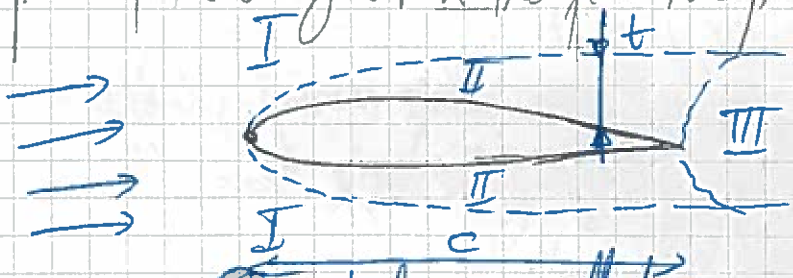
As the thickness of boundary layer increases, the pressure drag increases

This part of the (aerodynamic) drag becomes the most significant part of the drag when the flow is separated



The flow around the welt surface of the solid body looks like in the figure

(I) Reg List of viscous effects are not visible

In this region, one may use an approx. for stress tensor typically for an ideal fluid $T \cong -pI$ (w/o viscous stresses, on)

(II) Reg Viscous Effects are Dominant

In this certain reg, stress tensor comp are

$T = -pI + \tau$

Boundary - Layer Reg!

- t = thickness of boundary layer

$\frac{t\,(mm)}{c\,(m)} \sim \frac{1}{\sqrt{Re}}$, $Re \sim$ Reynolds Number $10^6 \div 10^8$

(III) Viscous Wake (~Dâra Vâscoasă)

Extents to the infinity downstream and in this reg viscous effects are diminishing with the distance from the trailing edge of the body

~~wave Drag~~ III^{rd} Part

(3) The wave drag (rezistența de undă)

- the drag created by the pressure forces on the aircraft surface due to presence of supersonic flows and in particular to the presence of shock-waves

Simply said, shock wave = thin layer through w a sudden decrease of the velocity and also sudden increases of thermody. variables p, ρ and T (?)

④ The induced drag

- the drag created by press forces due to the so-called "trailing vortex systems" or, other terms, due to vortex weight (dâra de vârtejuri) arising from the generation of lift
- lift-dependent drag

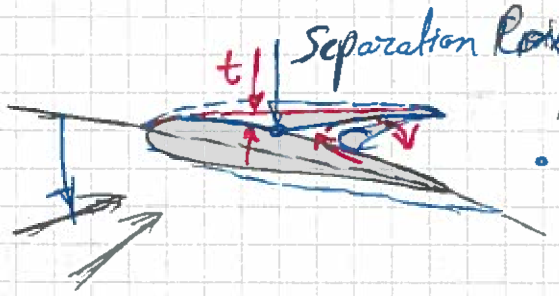
This type of drag only exists in 3D flows

$$\text{So, } D = \underbrace{D_f + D_p + D_w}_{2D} + D_i \quad // 3D$$

- The induced drag (due to lift) is due to the finite span of the wing

We are speaking about an airfoil (imag. / hypoth. wing having a span $\to \infty$)

Further, the chord, & geometry (thickness) remain unchanged



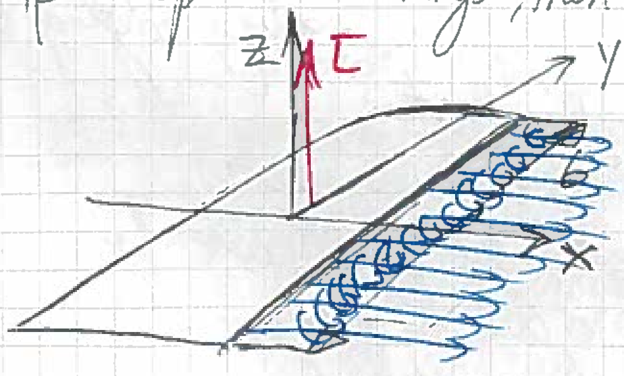
$\tau_w = 0$

No friction ⇒ Velocity will be

- Continues with the wake

Pressure Drag increases dramatically, more important than friction Drag

If we speak about wings, then



b = wing span

If the flow gen Γ, then downstream of the trailing edge of the wing we will have some vortices, "vortex wake"

In order to maintain such a flow which has a vortex ~~wake~~ wake, it is necessary to act on the fluid with a force and the opposite of the force is the induced drag

The concept was introduced first by Lancaster and by Ludwich Prandtl ("Finite Span Wing")

The main part of the drag is created by the pressure distribution (pressure forces distrib) on the wetted surface and so it is important to det first the pressure acting on the surface of the airfoil (aircraft

Lift and Drag

ref surface (wing S)

	3D	2D [N/m] "span"
L	$L = q_\infty S C_L$	$l (=L) = q_\infty c C_l$
D	$D = q_\infty S C_D$	$d (=D) = q_\infty c C_d$

ref length (chord)

*Reference "Design for" "Air Combat"

Dynamic Pressure

$$q_\infty = \frac{1}{2} \rho_\infty V_\infty^2 \quad \Big| \quad \frac{N}{\frac{N}{m^2} m^2}$$

$C_{D_i} \sim \frac{C_L^2}{AR}$ - aspect ratio

" $\lambda = \frac{b^2}{S}$

Lift and Drag are written in a dimensionless form,

C_L, C_D = dimensionless lift & drag coeff

2D, L, D – forces calc. per unit lengths

Usually, the ref surface is the surface/area of the projection of the wing onto the x-y plane