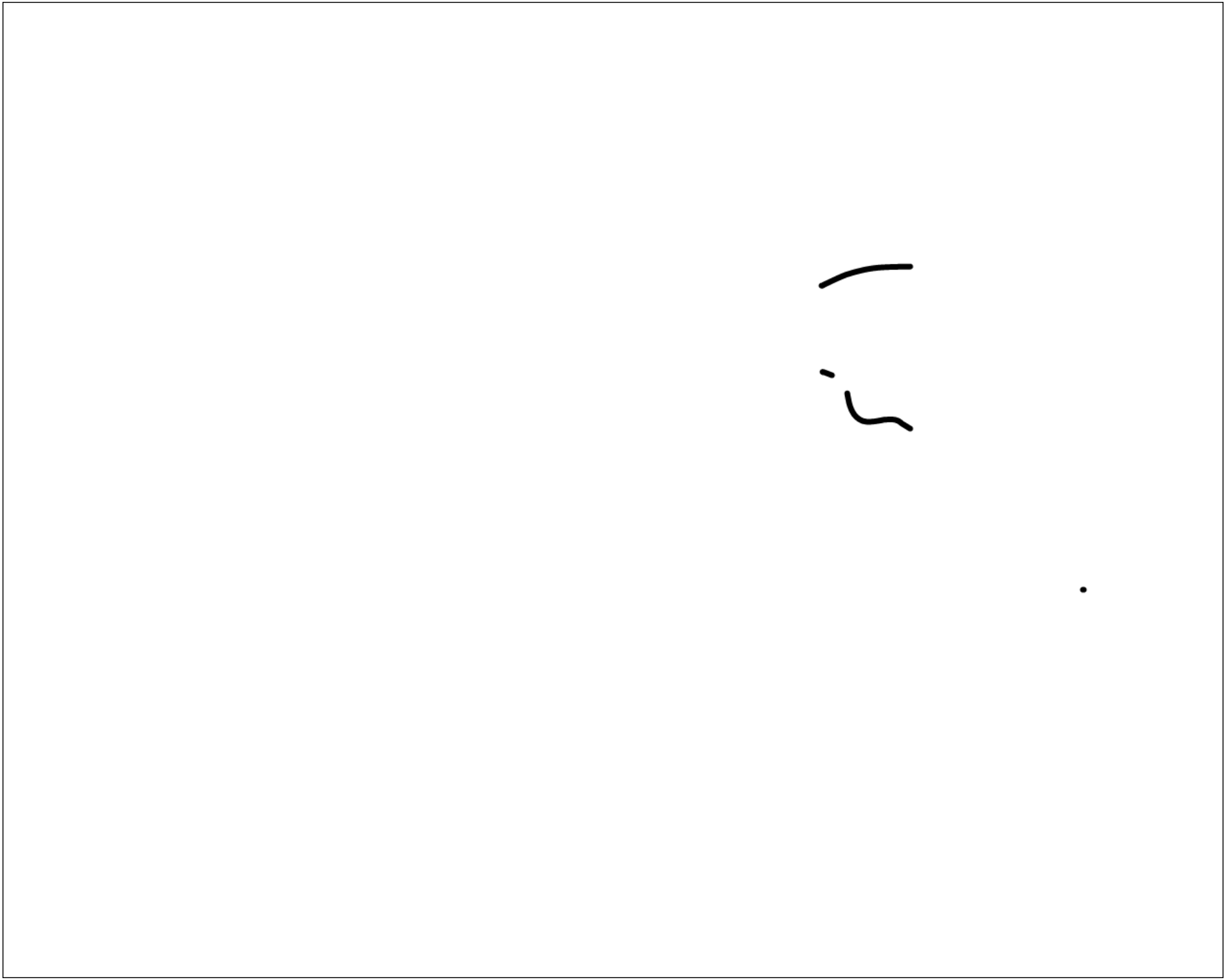
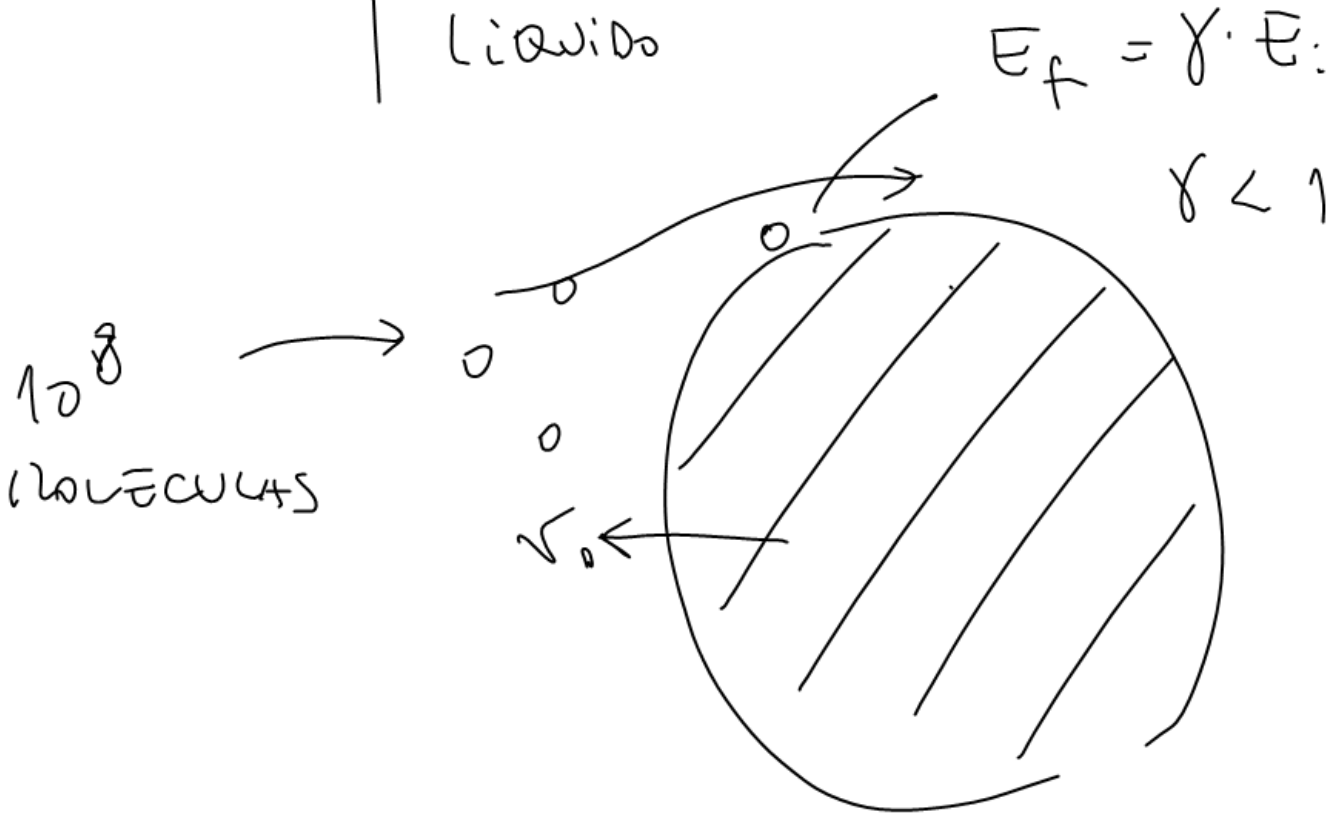
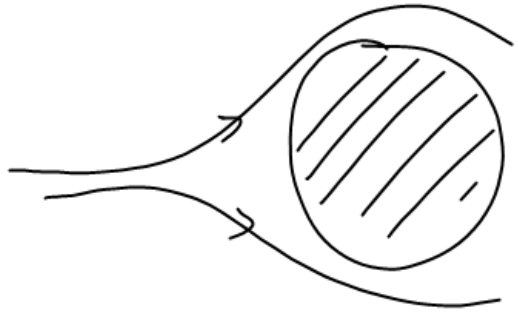


INTERACCION FLUIDO - CUERPOS

FLUIDO { GAS, LIQUIDO }

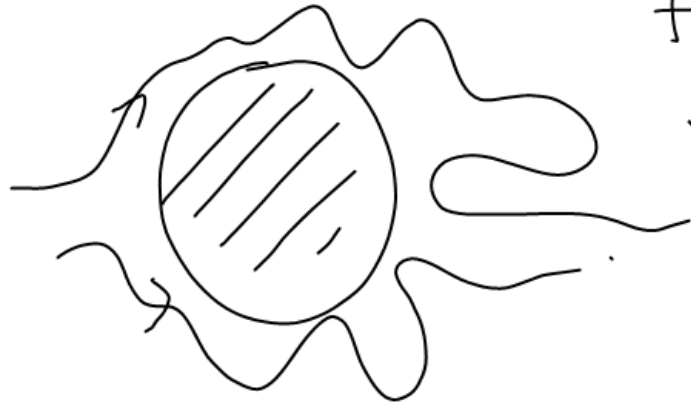


Dependiendo de V_0



flujo laminar

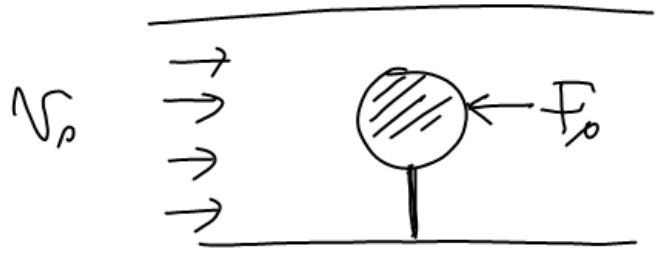
V_0 pequeño

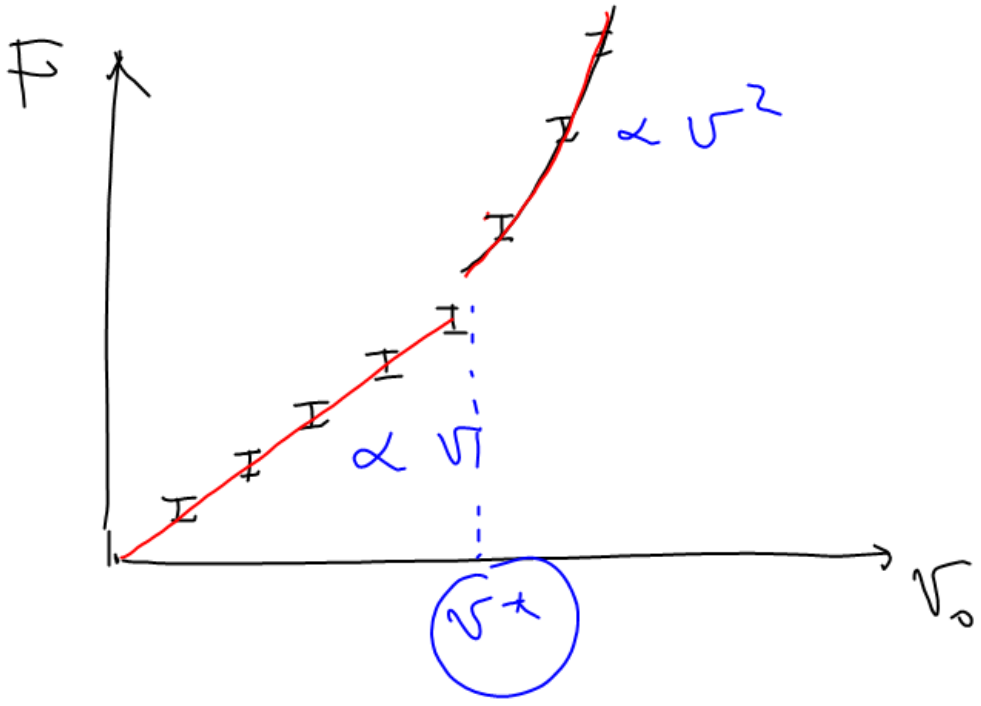


flujo Turbulento

V_0 grandes

Experimento Virtual:





La condición que produce el cambio del rango lineal al cuadrático este característico

$$Re = \frac{v_0 L}{\eta}$$

L: Dimensión cuerpo

η: Viscosidad

Re pequeño $\rightarrow F_f \propto v$

Re grande $\rightarrow F_f \propto v^2$

10^4

Caso simples:

1.

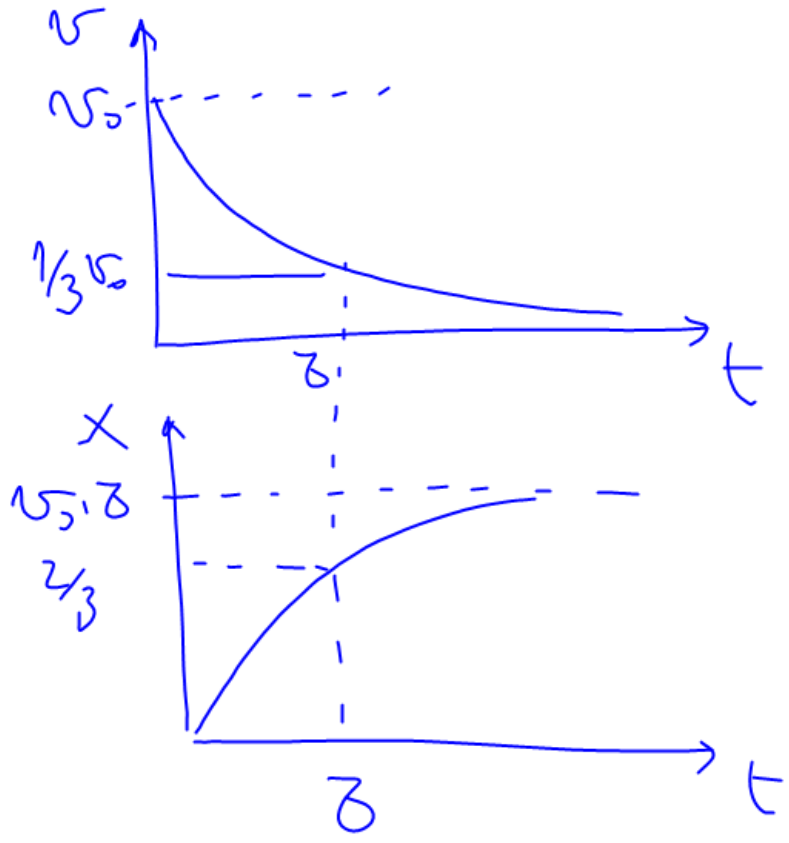
$$m\ddot{x} = -b\dot{x}$$

$$\frac{dv}{dt} = -\frac{b}{m} \cdot v \qquad v(t)$$

$$v = v_0 \cdot e^{-t/\tau}$$

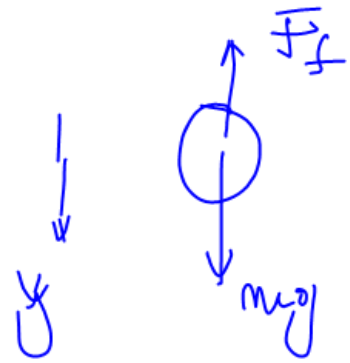
donde $\tau = \frac{m}{b}$

$$x(t) = v_0 \cdot \tau \left(1 - e^{-t/\tau}\right)$$



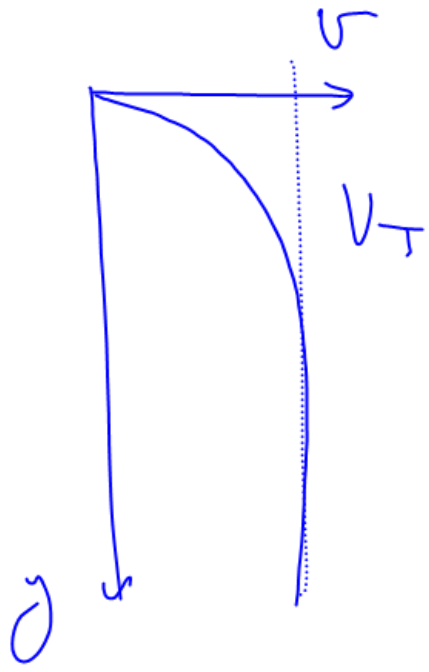
$$v(t) = v_0 \cdot e^{-t/\tau}$$

2. Caso:



$$m\ddot{y} = +mg - b\cdot v$$

$$\ddot{y} = g - \frac{b}{m}\dot{y}$$



$$\dot{y} = v(t) = V_T\left(1 - e^{-t/\tau}\right)$$

$$V_T = \frac{mg}{b}$$

Nos detalles sobre F_f.

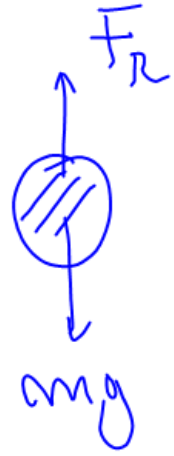
Esfera:

Re, v pequeña $\quad F_{Stokes} = 6\pi R \eta v$

Re, v grande $\quad F_{Rayleigh} = \frac{1}{2} \rho C_D \cdot A \cdot v^2$

$A = \pi R^2$

Regresamos a la caida libre



$$m\ddot{y} = mg - b\cdot(\dot{y})^2$$

Ec. Dif "Complicada"

Si $t \to \infty$

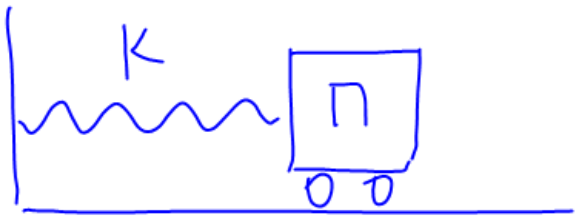
$V \to V_T$

$a \to 0$

$$mg = \frac{1}{2}\rho C_D A V_T^2$$

$$V_T = \left(\frac{2mg}{\rho C_D A}\right)^{1/2}$$

Caso 3. Viscosidad + Sist. Oscilatorio



$$m\ddot{x} = -kx$$

$$\ddot{x} = -\omega^2 x \qquad \omega = \sqrt{\frac{k}{m}}$$

$$x(t) = A\cos(\omega t + \phi)$$

$A, \phi \rightarrow$ CI

$$\omega = \sqrt{\frac{k}{m}} = \frac{2\pi}{T}$$

$$m\ddot{x} = -kx - b\dot{x}$$

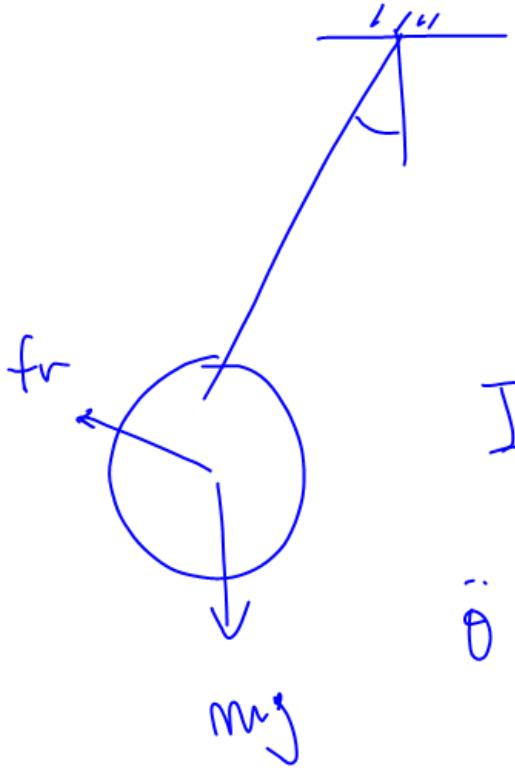
$$\ddot{x} + \frac{b}{m}\dot{x} + \frac{k}{m}x = 0 \qquad x(t) \; ?$$

$$x(t) = Ae^{-t/(2\tau)}\cos(\Omega t + \phi_0)$$

$$\tau = \frac{m}{b} \qquad \Omega = \omega_0 - \frac{1}{4\tau^2}$$

$$\omega_0 = \sqrt{\frac{k}{m}}$$

Lab. 4b



θ pequeño $< 5°$

$$\Sigma \tau = I\ddot{\theta}$$

$$I\ddot{\theta} = -mg \sin\theta L - b(\dot{\theta} \cdot L) \cdot l$$

$$\ddot{\theta} + \omega^2\theta + b \cdot \dot{\theta} = 0$$