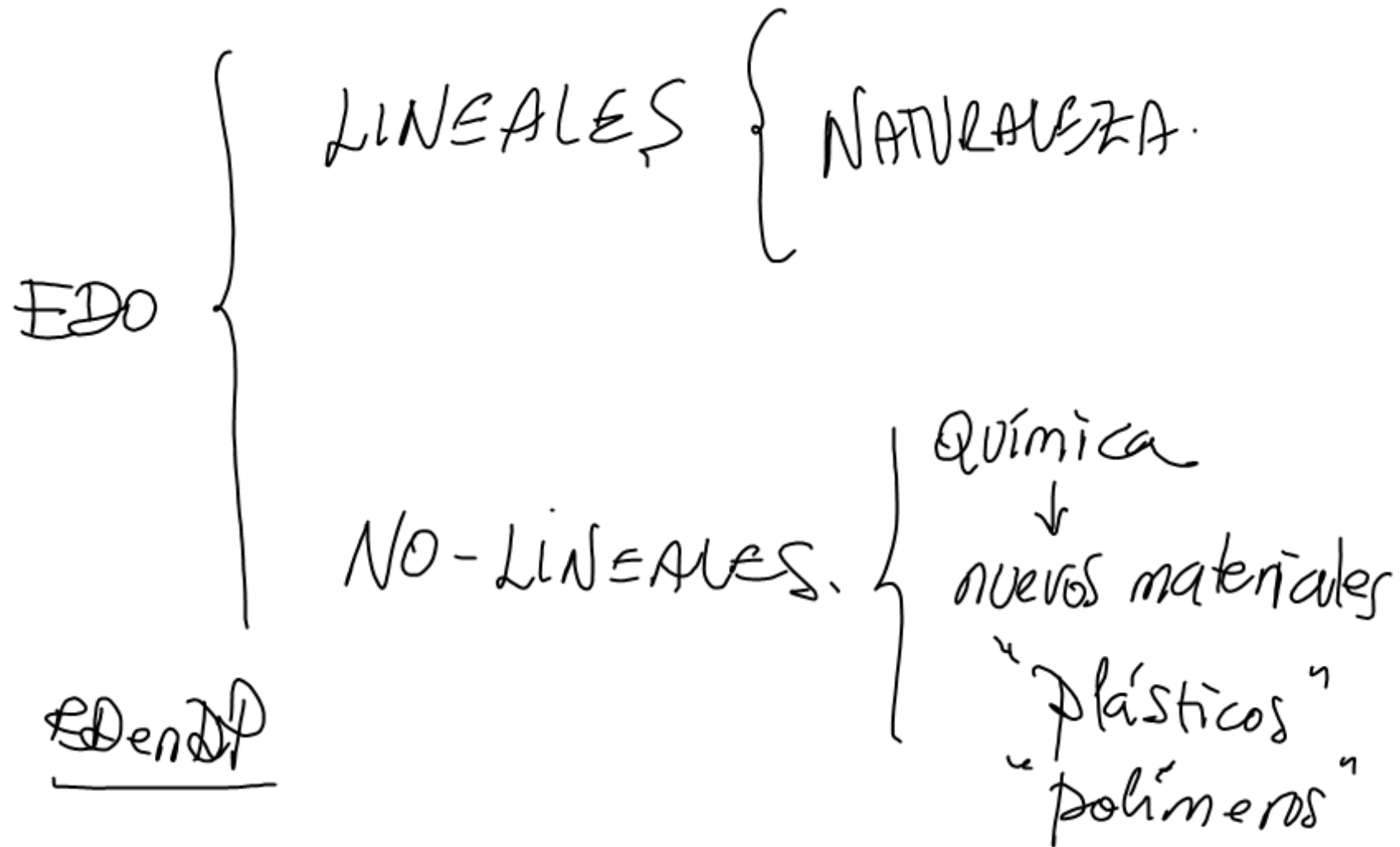
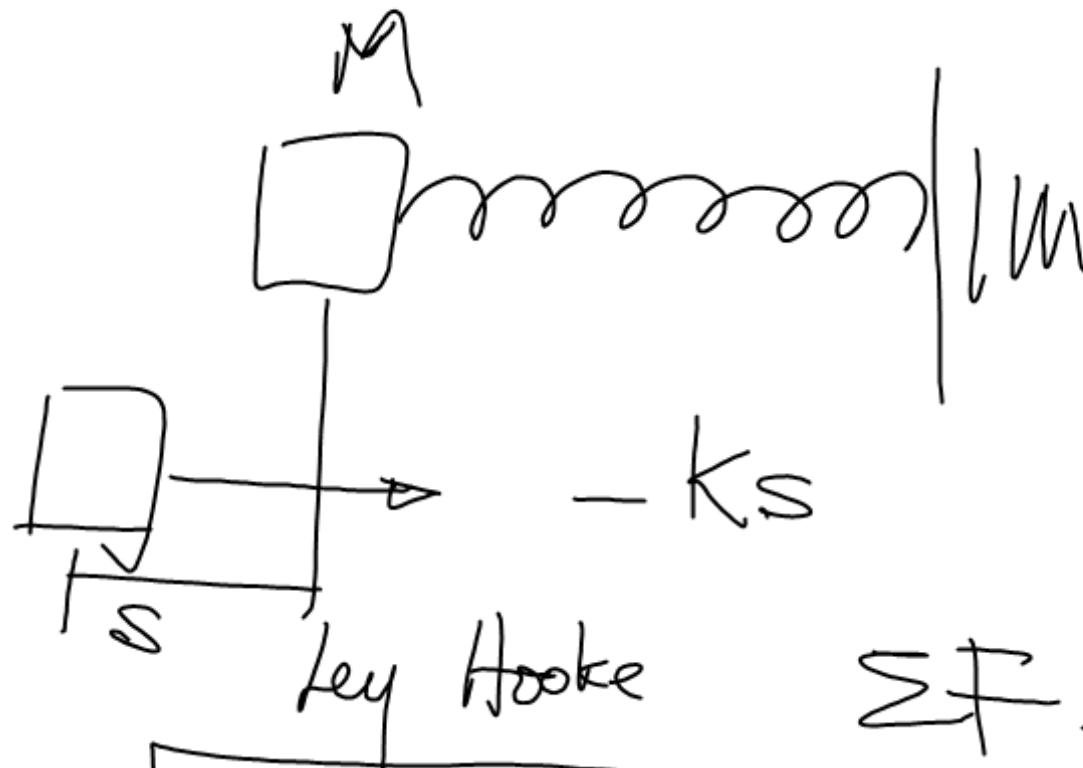


Ecuaciones Diferenciales

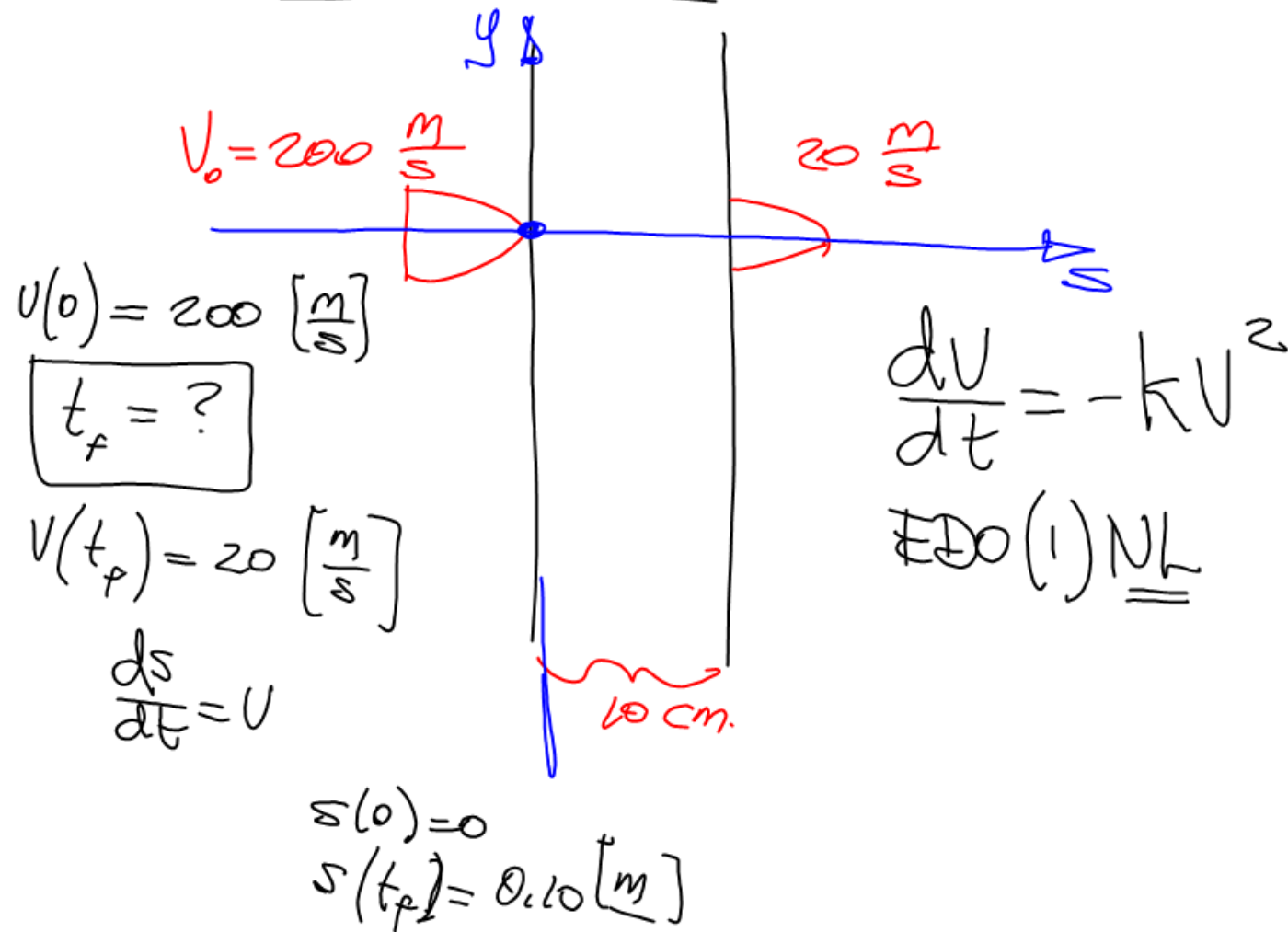




$$M \frac{d^2 s}{dt^2} = -ks.$$

$$\Sigma F = M a_s \frac{d^2 s}{dt^2}$$

NO-LINEAL



$$\frac{dV}{dt} = -kV^2$$

método
variables
separables

EDO(1) NL.
↑

$$\frac{dV}{V^2} = -k dt$$

$$\int V^{-2} dV = -k \int dt$$

$$\frac{V^{-1}}{-1} + k_1 = -k(t + t_2)$$

$$-\frac{1}{V} = -kt + (-kt_2 - k_1)$$

$$-\frac{1}{V} = -kt + C_1$$

solución
general.

$$V(0) = 200$$

$$-\frac{1}{200} = -k \cdot (0) + C_1$$

$$C_1 = -\frac{1}{200}$$

$$-\frac{1}{V} = -kt - \frac{1}{200}$$

$$\frac{1}{V} = kt + \frac{1}{200}$$

$$V = \frac{1}{kt + \frac{1}{200}}$$

solución
particular
 $V(t)$

$$\frac{ds}{dt} = \frac{1}{kt + \frac{1}{200}} \quad \text{EDO(1) LCC NH.}$$

MSV

$$ds = \frac{dt}{kt + \frac{1}{200}}$$

$$\int ds = \frac{1}{k} \int \frac{k dt}{kt + \frac{1}{200}}$$

$$s = \frac{1}{k} \ln \left(kt + \frac{1}{200} \right) + C_2 \quad s(0) = 0$$

$$\frac{1}{k} \ln \left(k(0) + \frac{1}{200} \right) + C_2 = 0$$

$$-\frac{1}{k} \ln \left(\frac{1}{200} \right) = C_2$$

$$s = \frac{1}{k} \ln \left(kt + \frac{1}{200} \right) - \frac{1}{k} \ln \left(\frac{1}{200} \right)$$

solución
particular
 $s(t)$

$$V = \frac{1}{kt + \frac{1}{200}} \quad V(t_p) = 20 \frac{M}{s}$$

$$S = \frac{1}{k} \ln\left(kt + \frac{1}{200}\right) - \frac{1}{k} \ln\left(\frac{1}{200}\right)$$

$$S(t_p) = 0,10 \text{ m.}$$

$$\frac{1}{10} = \frac{1}{k} \ln\left(k t_p + \frac{1}{200}\right) - \frac{1}{k} \ln\left(\frac{1}{200}\right)$$

$$\frac{k}{10} = \ln\left(\frac{k t_p + \frac{1}{200}}{\frac{1}{200}}\right)$$

$$\frac{k}{10} = \ln\left(\frac{\frac{200k t_p + 1}{200}}{\frac{1}{200}}\right)$$

quesadilla/km

$$\left(\frac{a}{t} \div \frac{s}{d}\right) = \left(\frac{ad}{tc}\right)$$

$$\frac{k}{10} = \ln(200k t_p + 1)$$

$$200k t_p + 1 = e^{\frac{k}{10}}$$

$$200k t_p = e^{\frac{k}{10}} - 1$$

$$t_p = \frac{e^{\frac{k}{10}} - 1}{200k}$$

$$\frac{1}{k \left(\frac{e^{\frac{k}{10}} - 1}{200k} \right) + \frac{1}{200}} = 20$$

$$\frac{1}{\frac{e^{\frac{k}{10}} - 1}{200} + 1} = 20$$

$$\frac{200}{e^{\frac{k}{10}}} = 20$$

$$\frac{e^{\frac{k}{10}}}{200} = \frac{1}{20}$$

$$e^{\frac{k}{10}} = \frac{200}{20}$$

$$e^{\frac{k}{10}} = 10$$

$$\frac{k}{10} = \ln(10)$$

$$k = 10 \ln(10)$$

$$V = \frac{1}{10L(10)t + \frac{1}{200}}$$

 \Rightarrow

$$V = \frac{1}{23.02585t + 0.005}$$

$$t_f = \frac{e^{L(10)} - 1}{200(10L(10))}$$

$$V = \frac{1}{23t + 0.005}$$

$$t_f = \frac{10 - 1}{2000L(10)}$$

$$\Rightarrow \frac{9}{2000L(10)}$$

 \Rightarrow

$$1.95 \times 10^{-3}$$

$$0.002 \text{ s.}$$