

TODAY, Mon Feb, 4, 2019

26

* Various Quizzes (next page)

* Spring mass w/ distractions

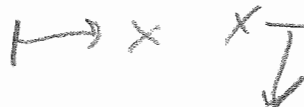
* multi-D.O.F. oscillation

$\left(\begin{array}{l} L \\ \text{of} \\ \text{Freedom} \end{array} \right) \text{ Degree(s)}$

Stereotype
Harmonic
Oscillator



or

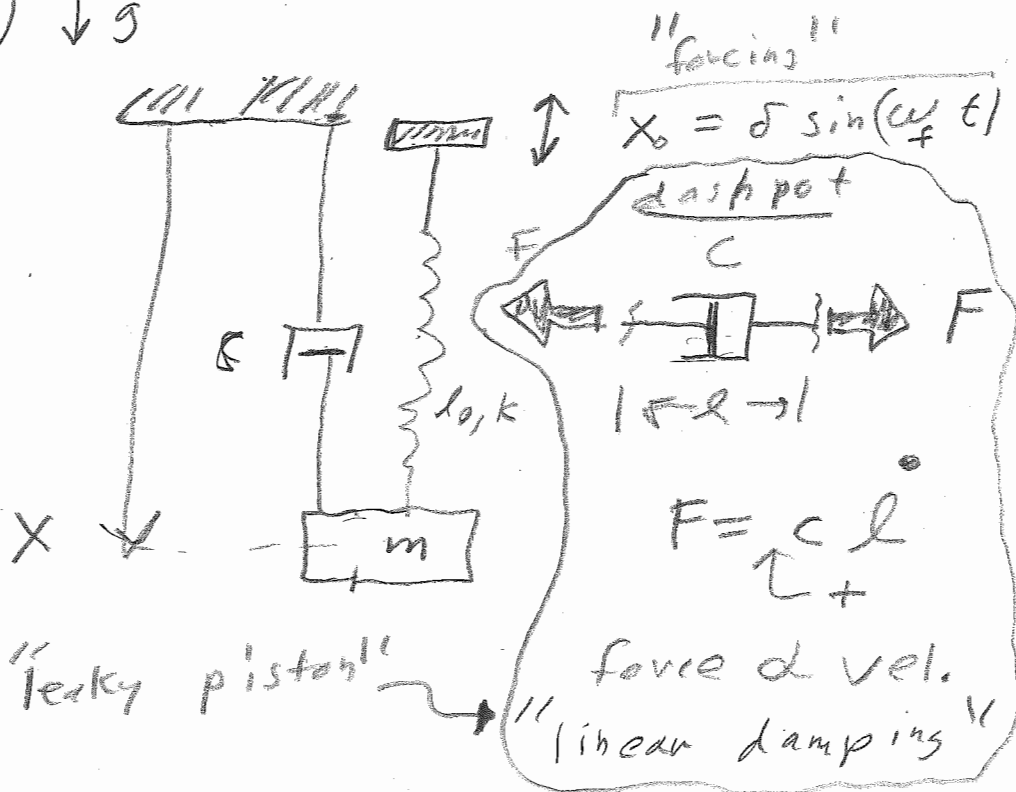


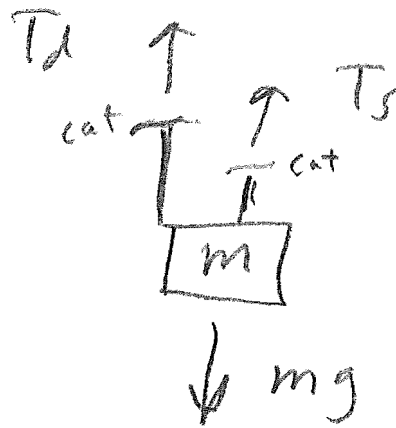
real problems:

complexifications,
distractions,
real life

$\left\{ \begin{array}{l} g_0 \neq 0, \quad g \neq 0 \\ \text{dashpot, shaking} \\ \text{foundations} \end{array} \right\}$ "forcing"

ex) $\downarrow g$





LMB

$$F = m a$$

$$L \ddot{x}$$

$$mg - T_s - T_d = m \ddot{x}$$

$$T_d = c \dot{x}$$

$$T_s = K (\Delta l)$$

$$\Delta l = l - l_0$$

$$L \quad x - x_0$$

$$L \quad \delta \sin(\omega_f t)$$

⇒ E.O.M

$$m \ddot{x} = -K(x - \delta \sin(\omega_f t) - l_0) - c \dot{x} + mg$$

2930 version

other stuff (28)

$\underbrace{\quad}_{\text{X stuff}}$

$$m\ddot{X} + c\dot{X} + KX = \underbrace{K\delta \sin(k_f t)}_{\text{wave}} + \underbrace{Kl_0 + mg}_{\text{const}}$$

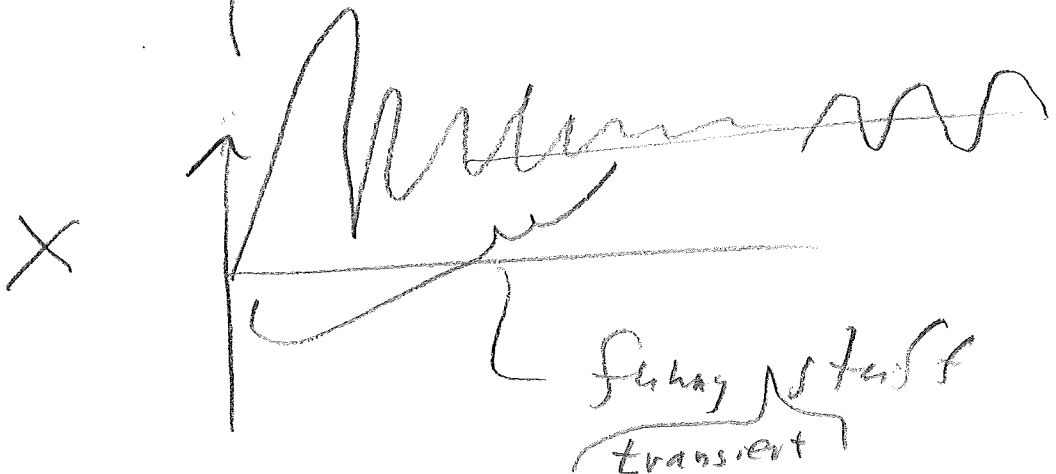
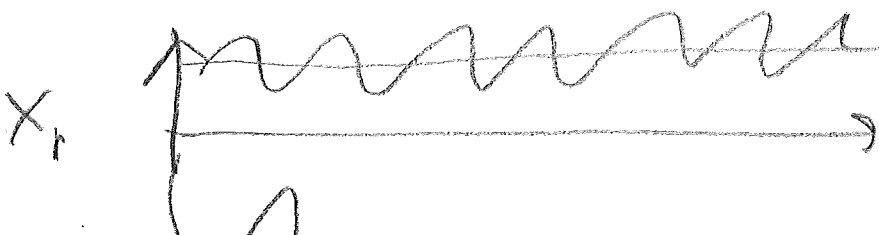
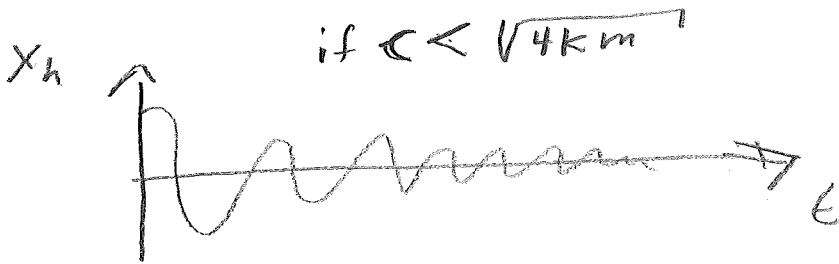
$m > 0, c > 0, K > 0$

Soln. Anal.

$$X \equiv X_h + X_p$$

$\uparrow$ transient
"homogeneous"

$\uparrow$ "particular"
steady state



(30)

$$T_1 = K(\Delta l_1) = K X_1$$

$$T_2 = K(\Delta l_2) = K(X_2 - X_1)$$

$$T_3 = K(\Delta l_3) = K(-X_2)$$

LNB:

$$m \ddot{X}_1 = T_2 - T_1$$

$$m \ddot{X}_2 = T_3 - T_2$$

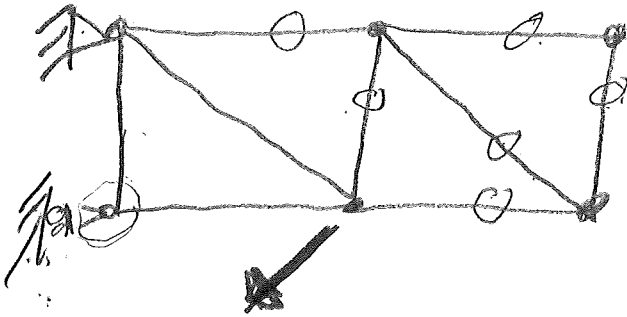
$$\Rightarrow \left\{ \begin{array}{l} m \ddot{X}_1 = K(-X_1 + X_2) \\ m \ddot{X}_2 = K(-X_2 + X_1) \end{array} \right.$$

Eqs. of motion

QUIZ 1 Feb. 4

(31)

2D, No gravity



How many "zero-force members" (bars w/ $T=0$)

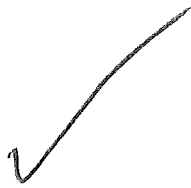
a) 0

b) 2

c) 4

d) 6

e) None of above



Quiz 2 Feb 4

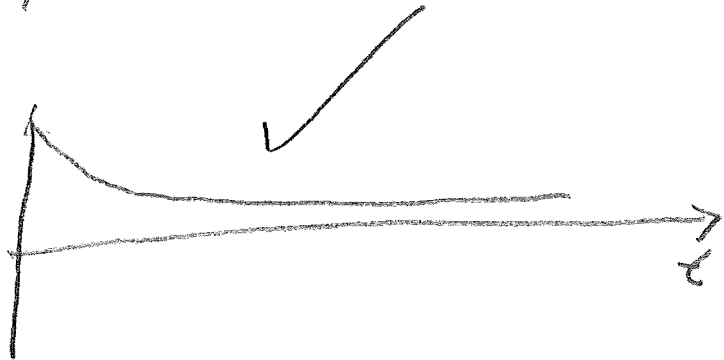
(32)

$$f(t) = a e^{-bt}$$

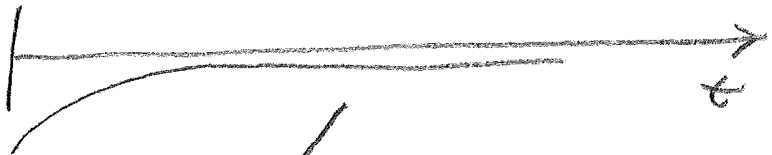
$$a > 0, b > 0$$

graph?

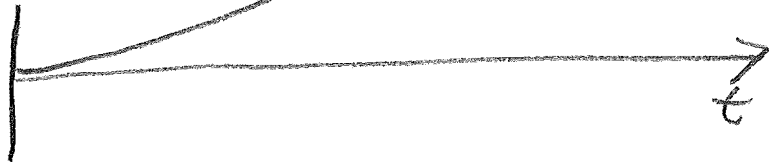
a)



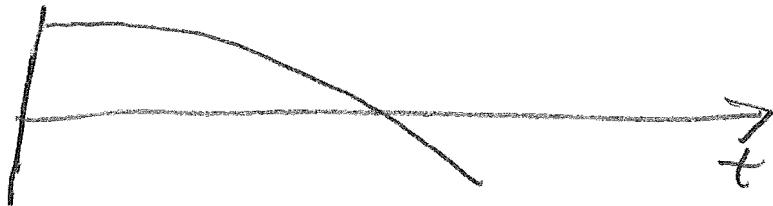
b)



c)



d)



e)



Quiz 3, Feb 4

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If $\dot{x} = 2x$ and $h = 0.1$
and $x_0 = 3$
 $at = t = 0$

For Euler's method

$$x(t=0.1) = ?$$

- a) 3
- b) 3.1
- c) 3.2
- d) 3.3
- e) 3.6 ✓

Solve!

$$x(t+h) =$$

$$\begin{aligned} x(t) + h \cdot \dot{x} \\ \quad \quad \quad \uparrow \\ \quad \quad \quad .1 \quad 2 \times 3 = 6 \\ = 3 + .6 \\ = 3.6 \end{aligned}$$