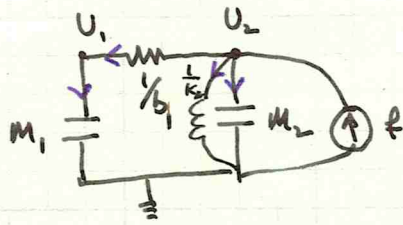


Solution HW #1:

1.

(a)



(b)

$$\text{node } U_2: F = \frac{U_2 - U_1}{\frac{1}{b_1}} + \frac{U_2}{\frac{s}{k_2}} + \frac{U_2}{\frac{1}{M_2 s}} \Rightarrow f = b_1 (i_2 - i_1) + u_2 k_2 + i_2 M_2$$

node U_1

$$\frac{U_2 - U_1}{\frac{1}{b_1}} = \frac{U_1}{\frac{1}{M_1 s}} \Rightarrow b_1 (u_2 - u_1) = M_1 i_1$$

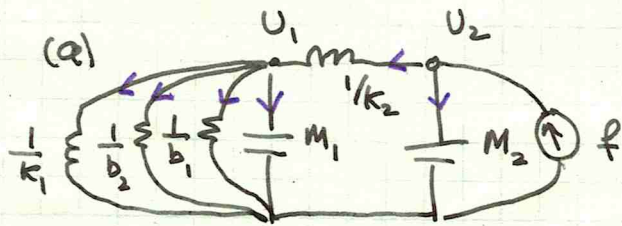
(c)

node U_1

$$(U_2 - U_1) b_1 = M_1 s U_1 \Rightarrow U_2 b_1 = M_1 s U_1 + b_1 U_1$$

$$\frac{U_2}{U_1} = \frac{M_1 s + b_1}{b_1}$$

2.



(b) node U_2 :

$$F = \frac{U_2}{\frac{1}{M_2 s}} + \frac{U_2 - U_1}{\frac{s}{k_2}}$$

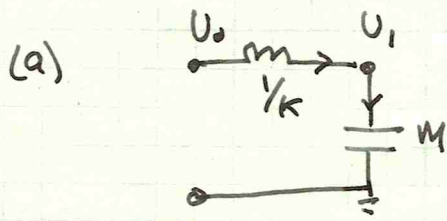
node U_1 :

$$\frac{U_2 - U_1}{\frac{s}{k_2}} = \frac{U_1}{\frac{1}{b_1}} + \frac{U_1}{\frac{1}{b_2}} + \frac{U_1}{\frac{s}{k_1}} + \frac{U_1}{\frac{1}{M_1 s}}$$

$$\dot{f} = m_2 \ddot{u}_2 + (u_2 - u_1) k_2$$

$$(u_2 - u_1) k_2 = (b_1 + b_2) \dot{u}_1 + k_1 u_1 + M_1 \ddot{u}_1$$

3.



(b)

$$\frac{u_0 - u_1}{\frac{1}{k}} = \frac{u_1}{\frac{1}{ms}} \Rightarrow \frac{(u_0 - u_1)k}{s} = u_1 ms$$

$$\frac{u_1}{u_0} = \frac{k}{ms^2 + k} = \frac{k}{m} \left[\frac{1}{s^2 + \frac{k}{m}} \right]$$

$$s \rightarrow 0 \quad \frac{u_1}{u_0} = 1$$

$$s \rightarrow \infty \quad \frac{u_1}{u_0} = 0$$