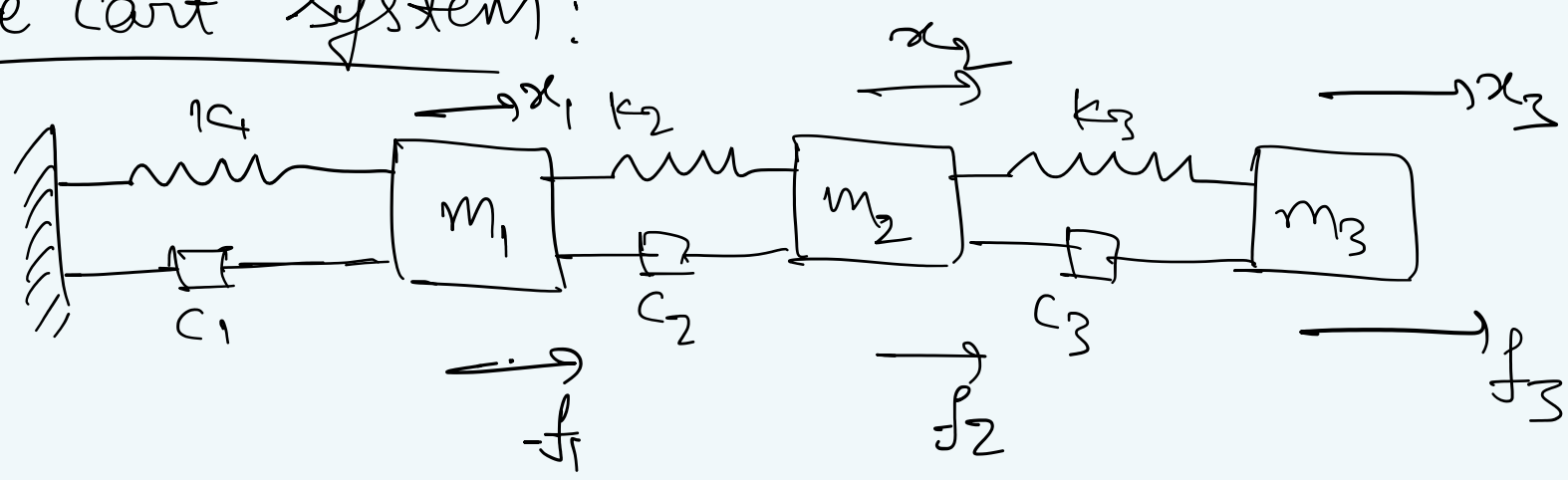
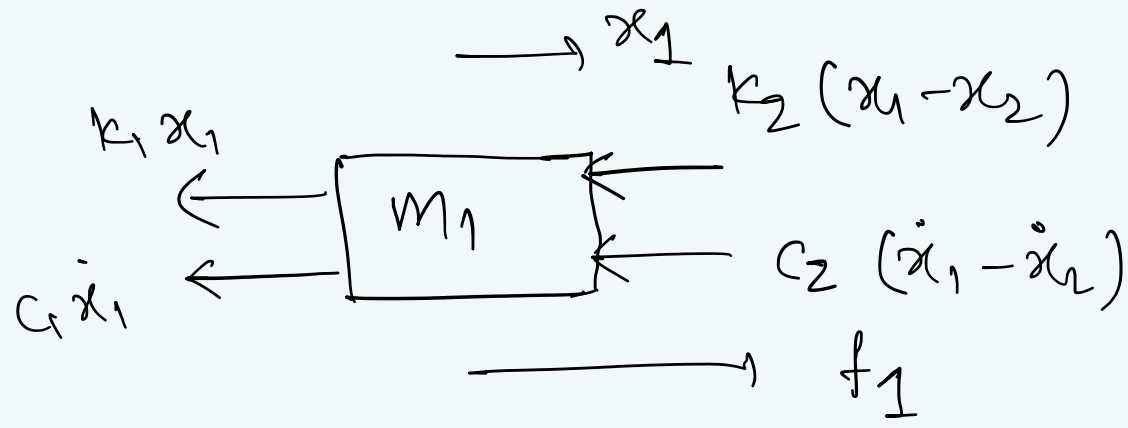
Thursday, 25 May 2023 11:09 AM

ETF_ Controls

Three Cart System:

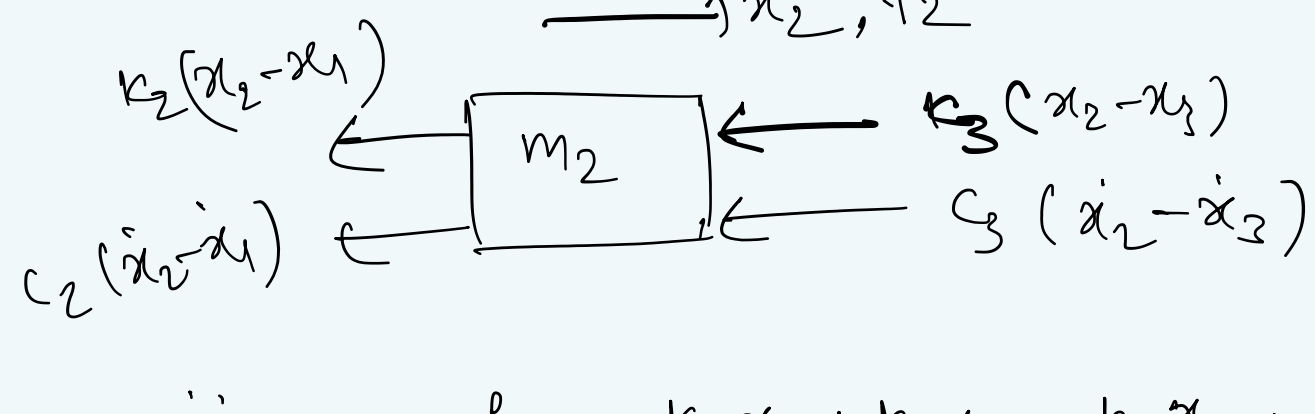


m_1 -



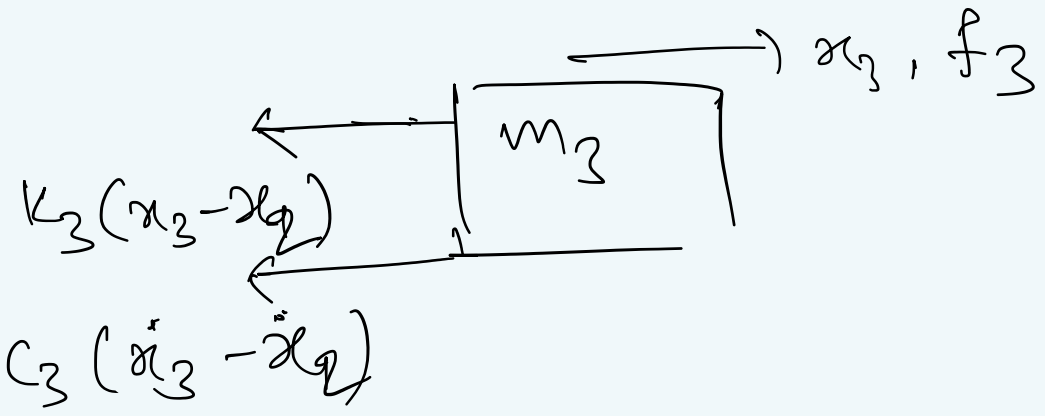
$$m_1\ddot{x}_1 = f_1 - k_1x_1 - k_2x_1 + k_2x_2 - c_1\dot{x}_1 - c_2\dot{x}_1 + c_2\dot{x}_2 \quad \text{(1)}$$

m_2 -



$$m_2\ddot{x}_2 = f_2 - k_3x_2 + k_3x_3 - k_2x_2 + k_2x_1 - c_2\dot{x}_2 + c_2\dot{x}_1 \quad \text{(2)}$$

m_3 -



$$m_3\ddot{x}_3 = f_3 - k_3x_3 + k_3x_2 - c_3\dot{x}_3 + c_3\dot{x}_2 \quad \text{(3)}$$

Equation (2) $\Rightarrow$

$$m_1\ddot{x}_1 = f_1 - k_1x_1 - k_2x_1 + k_2x_2 - c_1\dot{x}_1 - c_2\dot{x}_1 + c_2\dot{x}_2$$

$$(x1\_n+1) = x1\_n + (h)\,\dot{x}1\_n$$

$$(\dot{x}1\_n+1) = \ddot{x}1\_n+1 + h\,\ddot{x}1\_n$$

$$(\ddot{x}1\_n) = \frac{1}{m_1}\left(f_1 - k_1x1\_n - k_2x1\_n + k_2x2\_n - c_1\dot{x}1\_n - c_2\dot{x}1\_n + c_2\dot{x}2\_n\right)$$

numerical solution (Eulers method)