Lecture 4 - Homework

Problem 4.1
In homework problem 3-3, you developed a differential equation for the fluid transmission system shown.

The differential equation that represents this system may be written as shown.

\[ J \ddot{\theta} + D \dot{\theta} + K \theta = D \dot{\theta}_a \]

a) Complete the block diagram representation below for this system with \( \theta_a \) as the input and \( \theta \) as the output.

![Block diagram](image)

b) Using block diagram reduction techniques discussed in class represent the system with only one block.

![Block diagram reduction](image)

Problem 4.2
The differential equation for a space heating system can be written as shown below:

\[ RCT \dot{T}(t) + T(t) = Rq_i(t) \]

where \( R \) is the thermal resistance, \( C \) is the thermal capacitance and \( q_i \) is the heat inflow rate from an electrical heater. Sketch a simulation diagram for this system.

Assume that for a consistent set of units, \( C = 80 \) and \( R = 0.25 \). Implement this system in Simulink and plot the response of the system when \( q_i \) is an input step of 2. If the desired output of the system is 8 units, what is the required step input?