Homework 5

23. Writing the equations of motion, where $x_2(t)$ is the displacement of the right member of springs,

$$ (s^2 + s + 1)X_1(s) - X_2(s) = 0 $$

$$ -X_1(s) - X_2(s) = F(s) $$

Adding the equations,

$$ (s^2 + s)X_1(s) = F(s) $$

From which,

$$ \frac{X_1(s)}{F(s)} = \frac{1}{s(s + 1)} $$

25. Let $X_2(s)$ be the displacement of the left member of the spring and $X_3(s)$ be the displacement of the mass.

Writing the equations of motion

$$ 2X_1(s) - 2X_2(s) = F(s) $$

$$ -2X_1(s) + (5s + 2)X_2(s) - 5sX_3(s) = 0 $$

$$ -5sX_1(s) + (10s^2 + 7s)X_3(s) = 0 $$

Solving for $X_2(s)$,

$$ X_2(s) = \frac{5s^2 + 10}{-10 - 10} \frac{F(s)}{s(s^2 + 5s + 2)} $$

Thus,

$$ \frac{X_2(s)}{F(s)} = \frac{1}{10(s^2 + 5s + 1)} $$