Given Equations:

$$\frac{d^2\theta}{dt^2} = \frac{1}{J}\left(K_t i - b\frac{d\theta}{dt}\right)$$

$$\frac{di}{dt} = \frac{1}{L}\left(-Ri + v - K_e\frac{d\theta}{dt}\right)$$

My Garbage:

Applying Laplace to motion equation

$$s^2\theta(s) = \frac{1}{J}\left(K_t I(s) - bs\theta(s)\right)$$

$$\left(s^2 + \frac{b}{J}s\right)\theta(s) = \frac{K_t}{J}I(s)$$

Applying Laplace to voltage equation

$$sI(s) = \frac{1}{L}\left(-RI(s) + V(s) - K_e s\theta(s)\right)$$

$$(sL + R)I(s) = V(s) - K_e s\theta(s)$$

$$I(s) = \frac{V(s) - K_e s\theta(s)}{R + sL}$$

Combining the equations

$$\left(s^2 + \frac{b}{J}s\right)\theta(s) = \frac{K_t}{J}I(s) = \frac{K_t}{J}\left(\frac{V(s) - K_e s\theta(s)}{R + sL}\right)$$

$$\left(s^2 + \frac{b}{J}s\right)\theta(s) = \frac{K_t}{J(R + sL)}V(s) - \frac{K_t K_e}{J(R + sL)}s\theta(s)$$

$$\left(s^2 + \frac{1}{J}\left(b + \frac{K_t K_e}{R + sL}\right)s\right)\theta(s) = \frac{K_t}{J(R + sL)}V(s)$$

$$\boldsymbol{G(s) = \frac{\theta(s)}{V(S)} = \frac{\frac{K_t}{J(R + sL)}}{s^2 + \frac{1}{J}\left(b + \frac{K_t K_e}{R + sL}\right)s}}$$