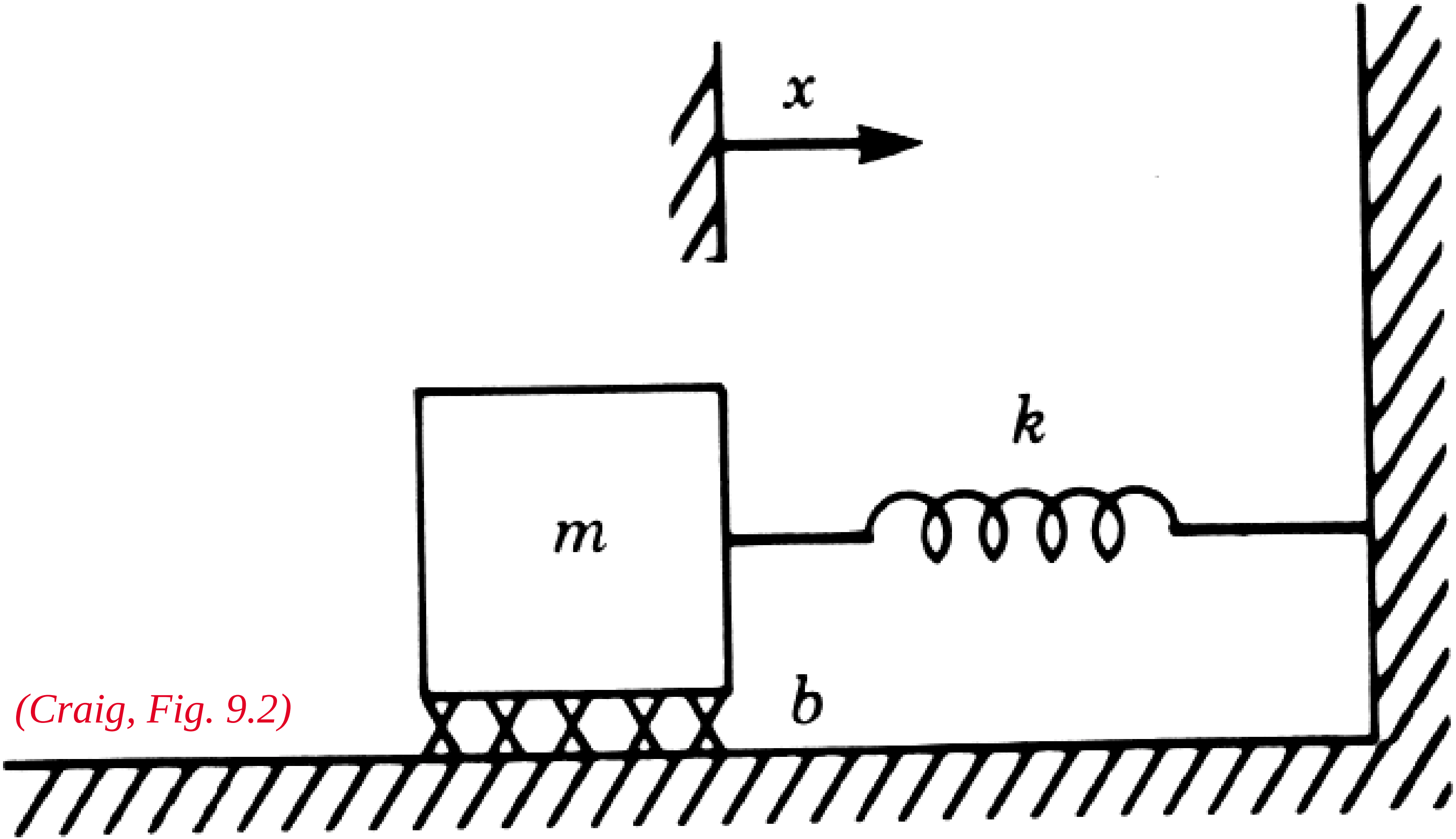
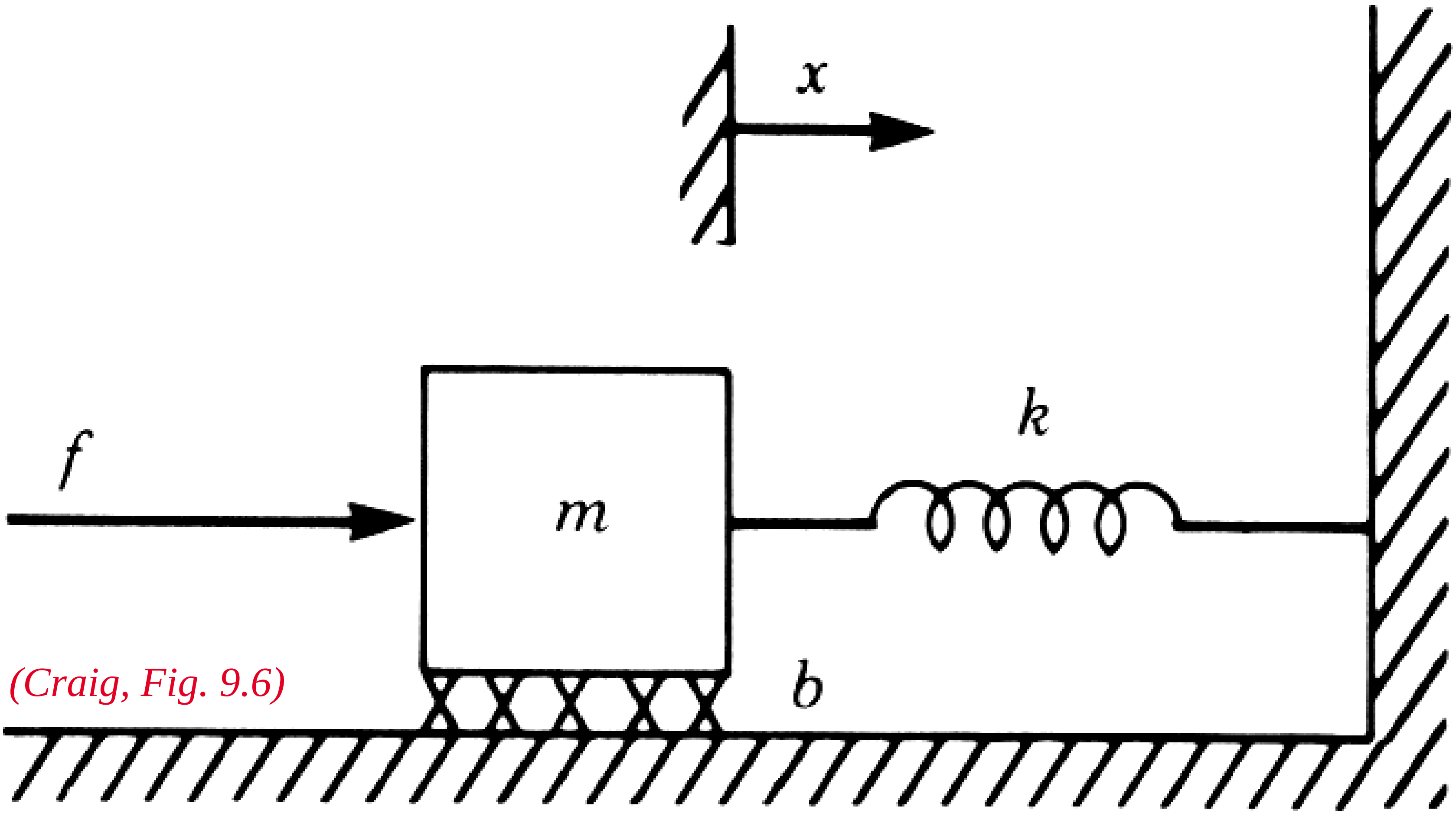


(Craig, Fig. 9.2)

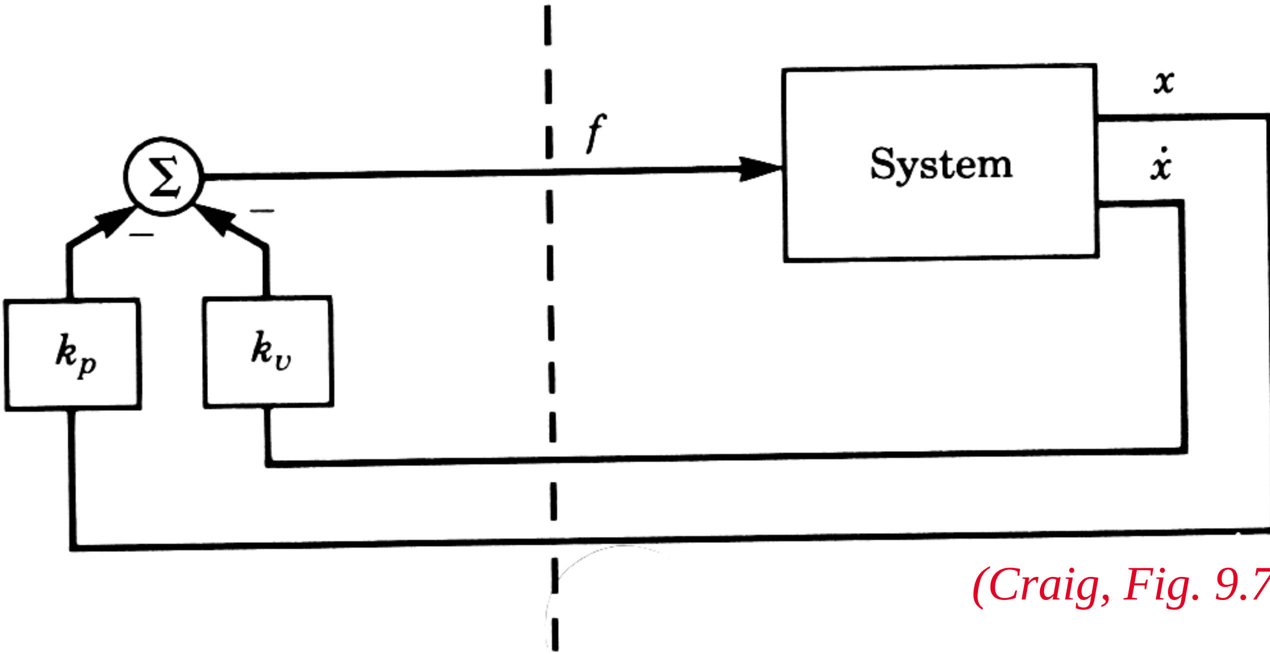
$$m\ddot{x} + b\dot{x} + kx = 0$$



(Craig, Fig. 9.6)

$$m\ddot{x} + b\dot{x} + kx = f$$

Simple PD Control Law



(Craig, Fig. 9.7)

$$f = -k_p x - k_v \dot{x}$$

Effective system dynamics

$$m\ddot{x} + b\dot{x} + kx = f$$

$$f = -k_p x - k_v \dot{x}$$

$$m\ddot{x} + b\dot{x} + kx = -k_p x - k_v \dot{x}$$

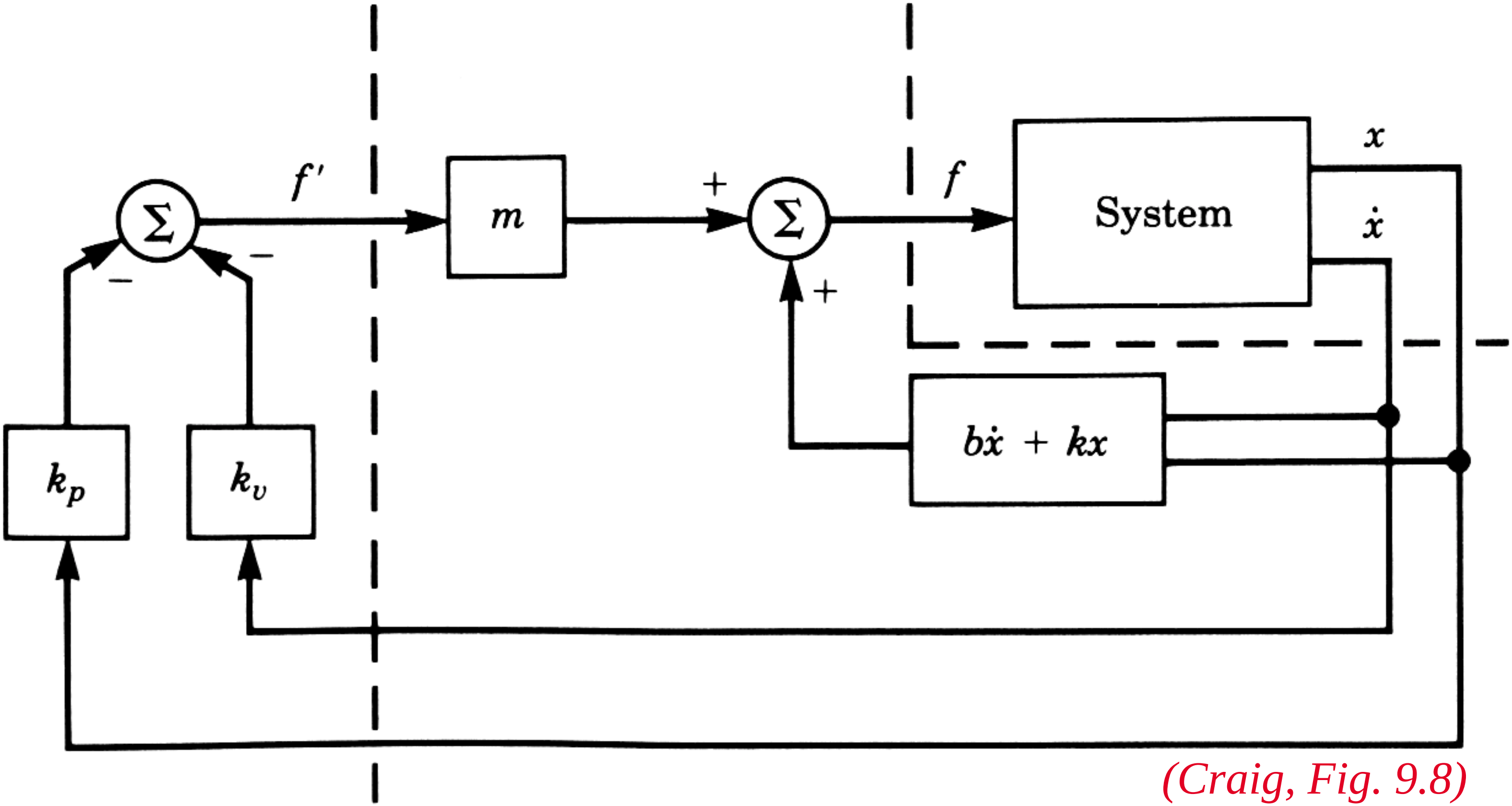
$$m\ddot{x} + (b + k_v)\dot{x} + (k + k_p)x = 0$$

$$m\ddot{x} + b'\dot{x} + k'x = 0$$

$$k' = (k + k_p)$$

$$b' = (b + k_v)$$

Control Law Partitioning



(Craig, Fig. 9.8)

$$m\ddot{x} + b\dot{x} + kx = f = \alpha f' + \beta$$

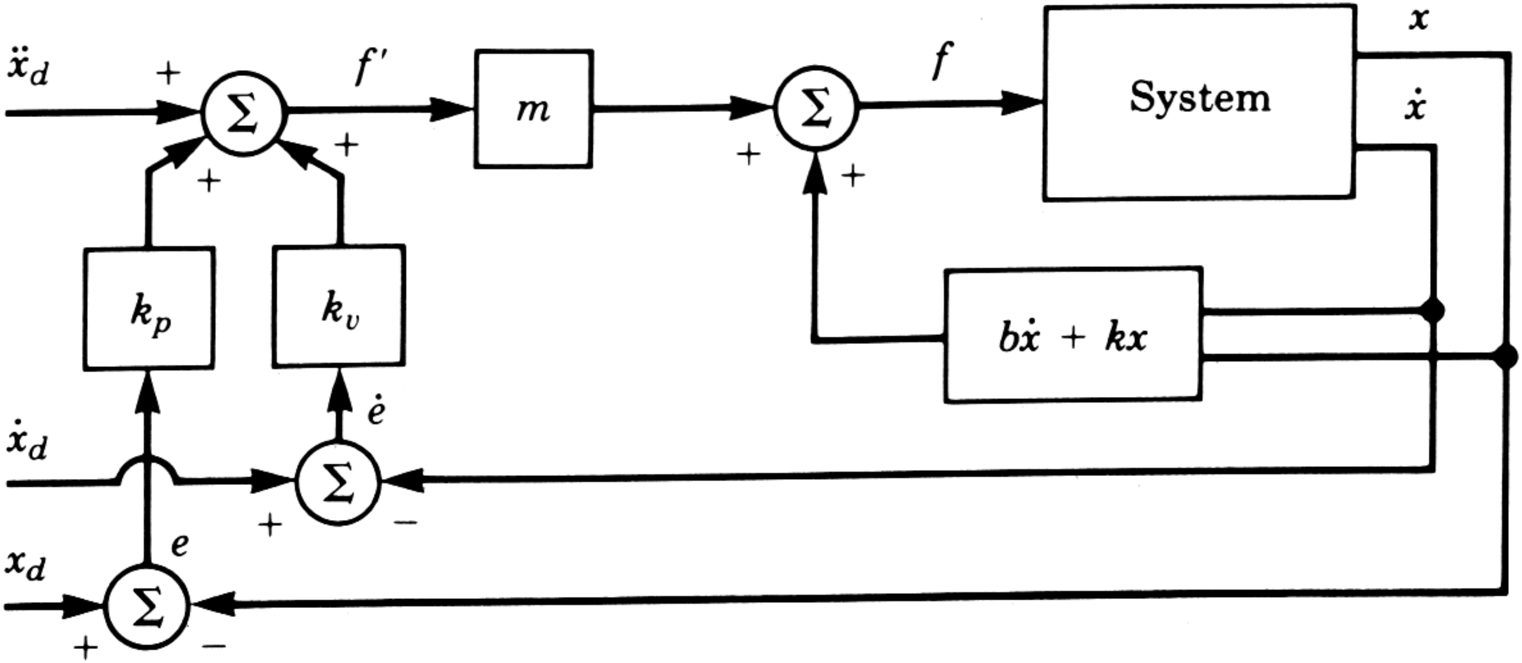
$$\alpha = m$$

$$\beta = b\dot{x} + kx$$

$$\ddot{x} = f'$$

$$f' = -k_p x - k_v \dot{x}$$

Control Law Partitioning (trajectory following)



(Craig, Fig. 9.9)

$$m\ddot{x} + b\dot{x} + kx = f = \alpha f' + \beta$$

$$\alpha = m$$

$$\beta = b\dot{x} + kx$$

$$\ddot{x} = f'$$

$$f' = \ddot{x}_d + k_v(\dot{x}_d - \dot{x}) + k_p(x_d - x)$$