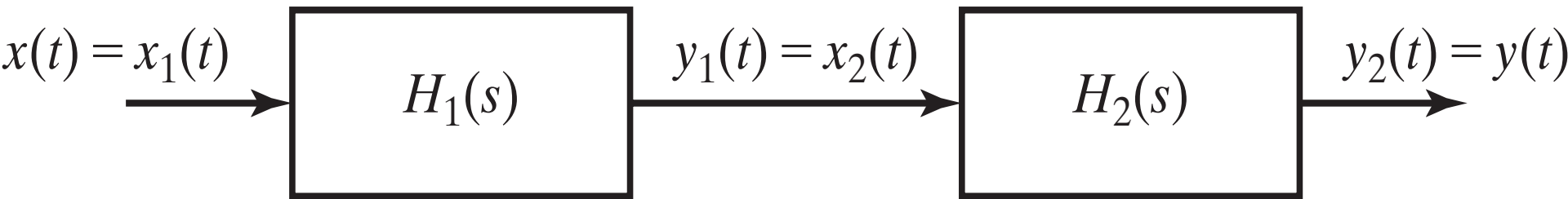


Observers for state estimation

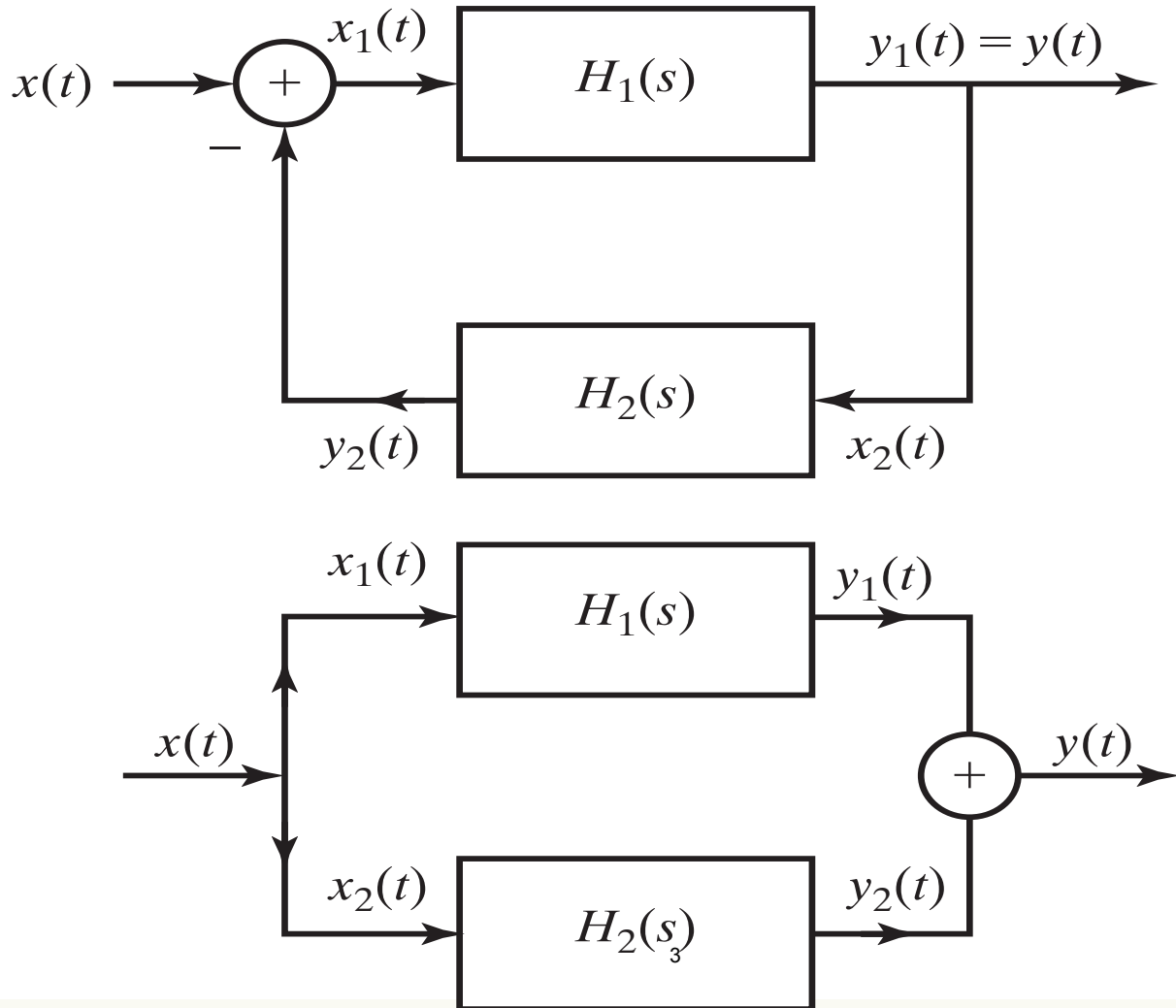
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Hidden modes of composite systems: series (cascade) connections

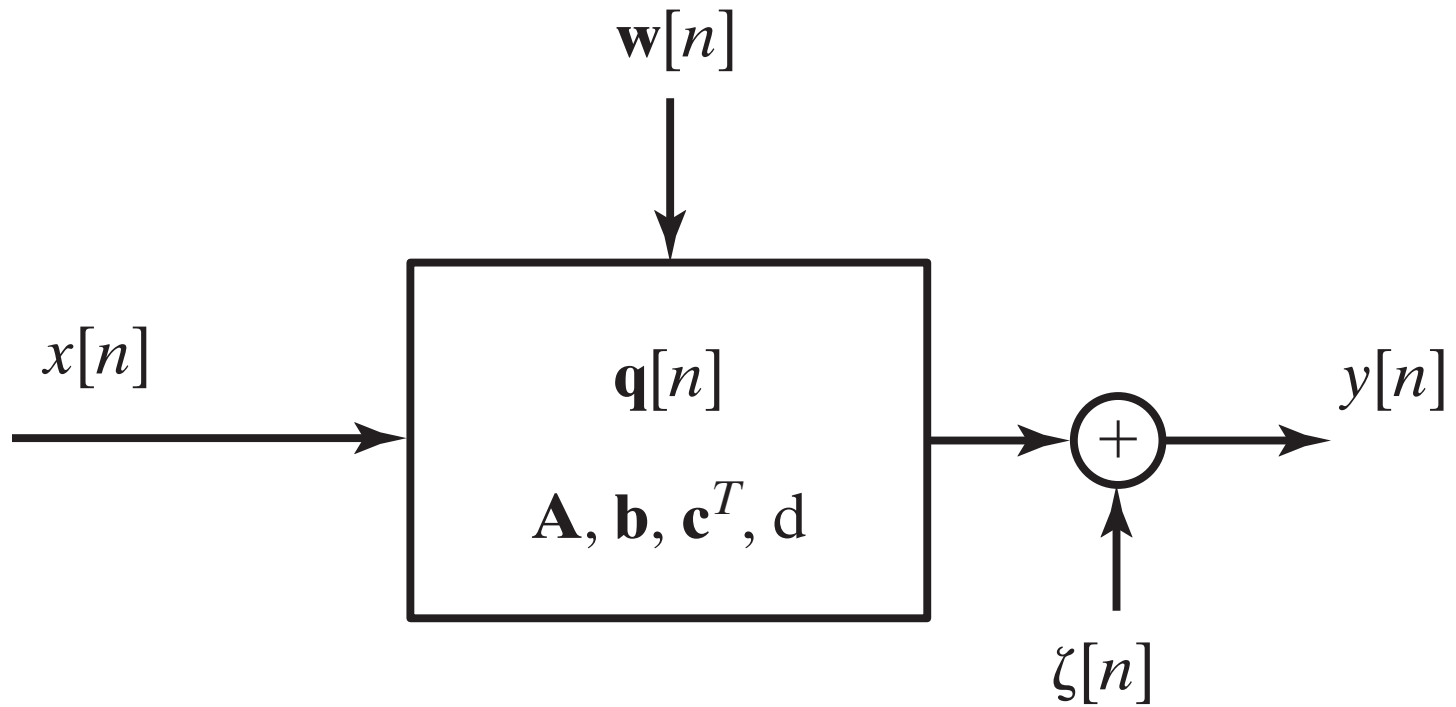


Hidden modes of composite systems: feedback and parallel connections

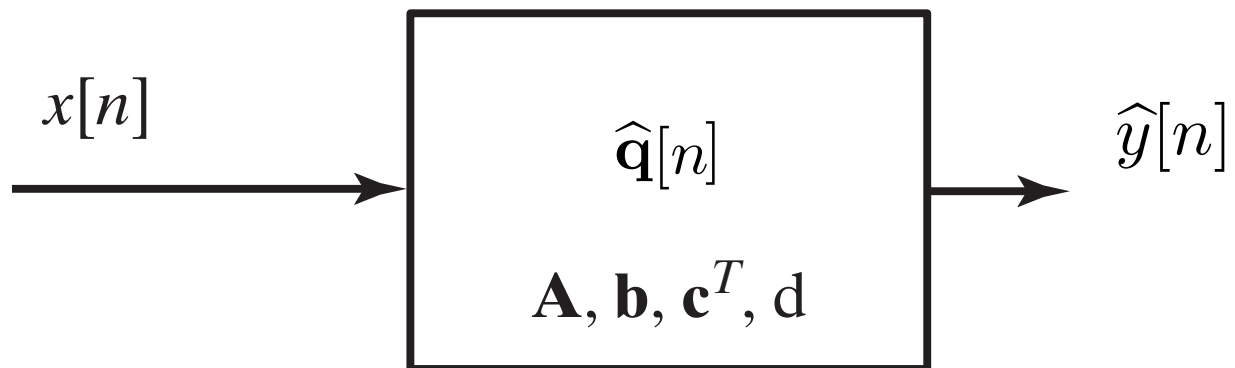


Observers

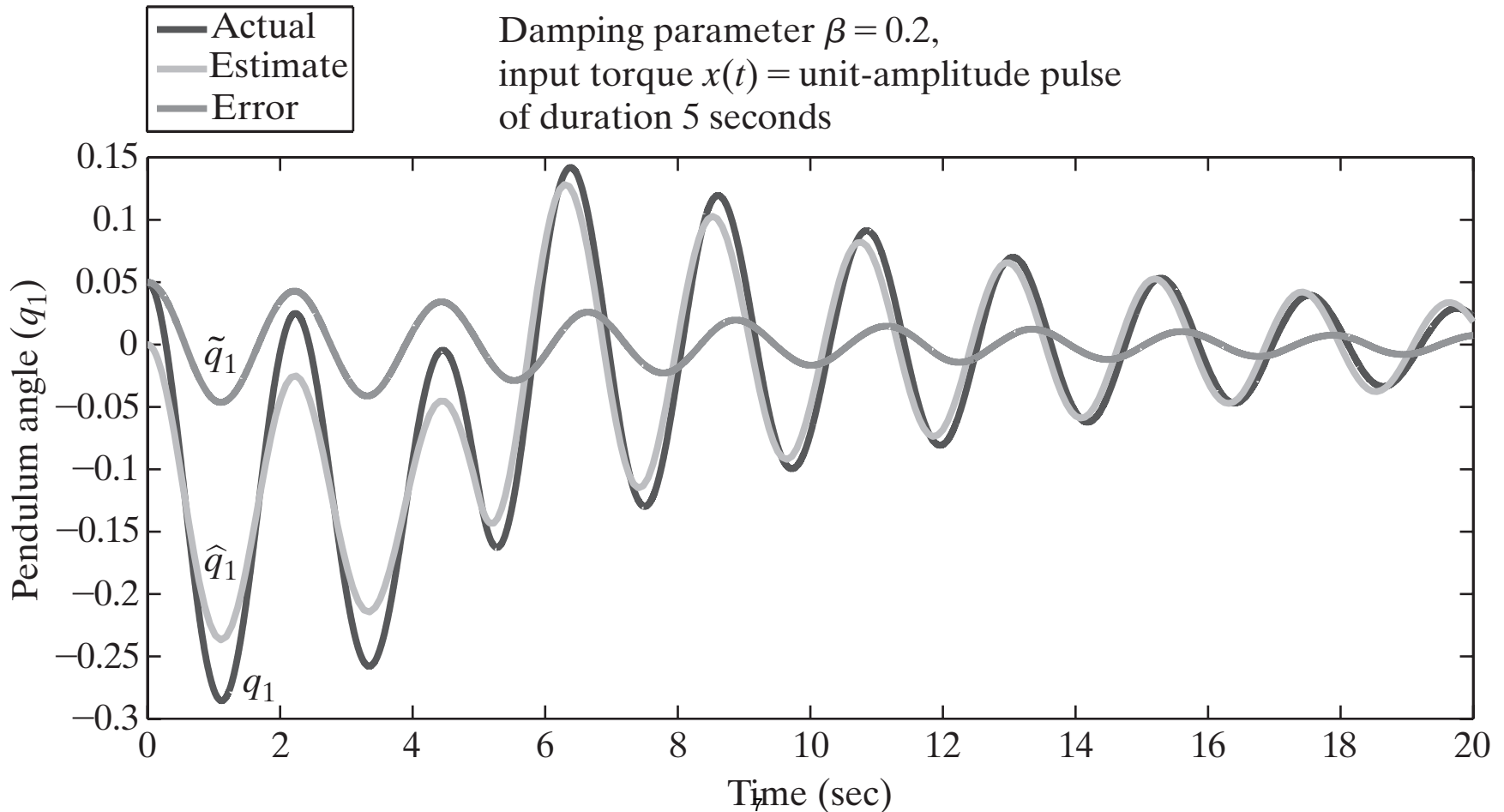
System (“plant”)



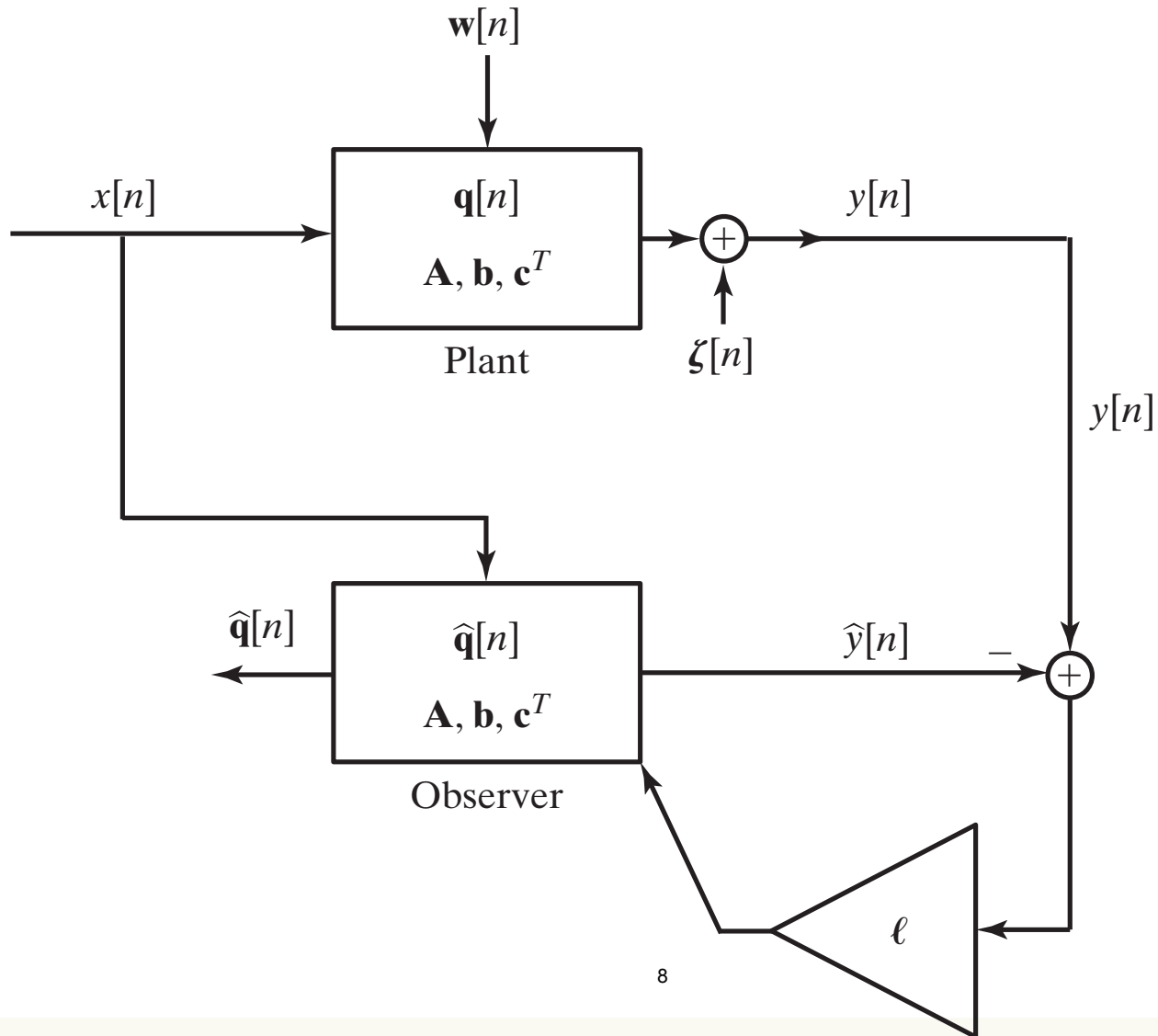
A good model



Performance of real-time simulation



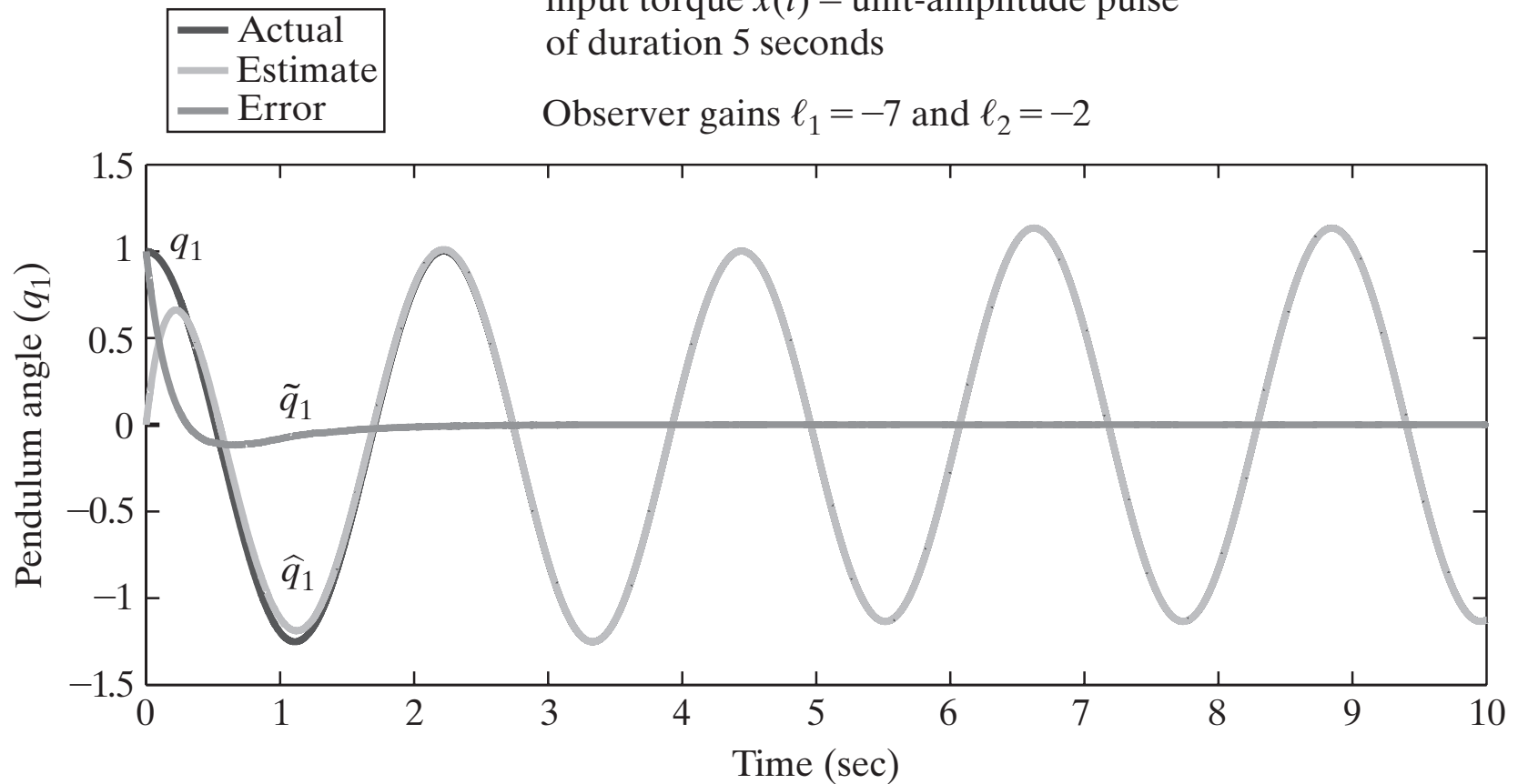
Observer configuration



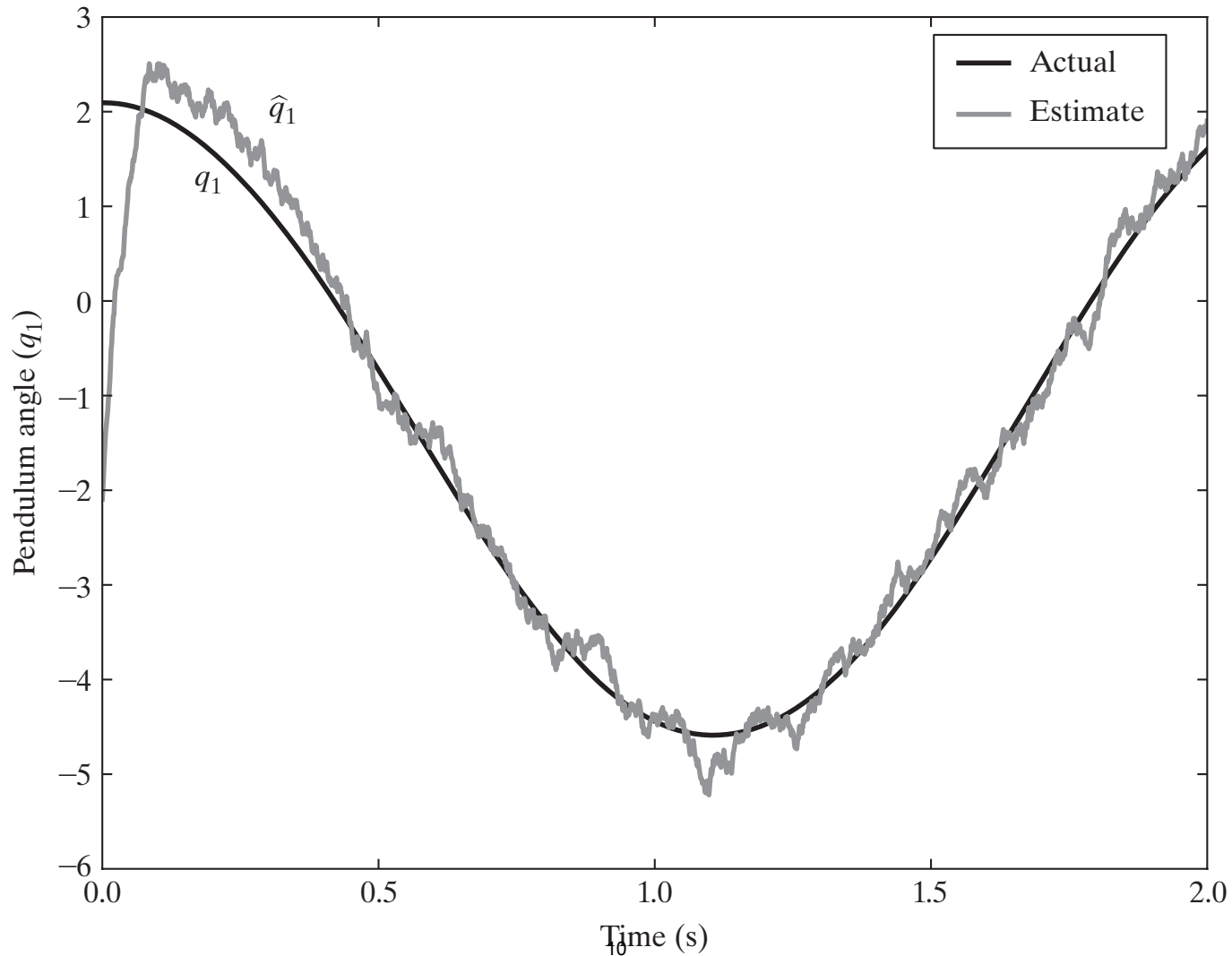
Observer performance (with no measurement noise)

Undamped suspended pendulum,
input torque $x(t)$ = unit-amplitude pulse
of duration 5 seconds

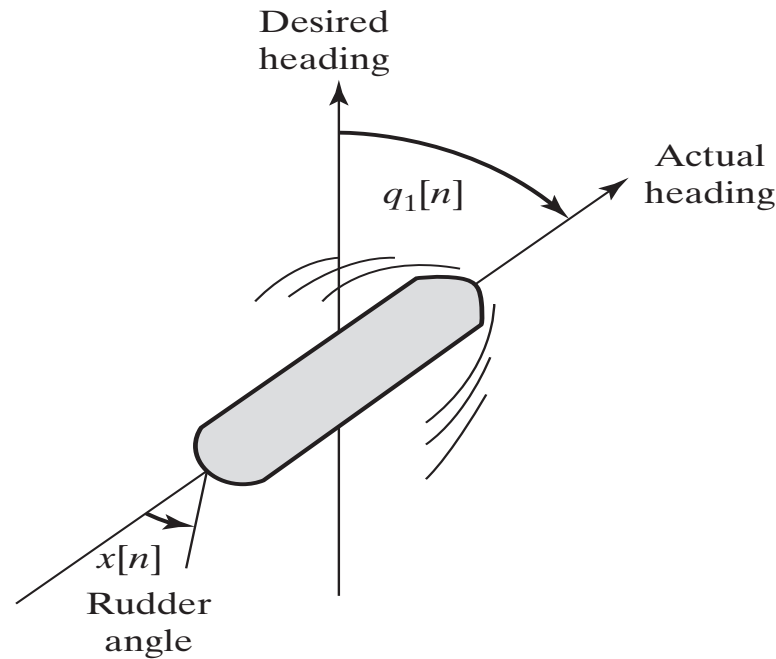
Observer gains $\ell_1 = -7$ and $\ell_2 = -2$



Observer performance (with measurement noise)



Observer for ship heading error



$$\begin{aligned} \mathbf{q}[n + 1] &= \begin{bmatrix} q_1[n + 1] \\ q_2[n + 1] \end{bmatrix} = \begin{bmatrix} 1 & \sigma \\ 0 & \alpha \end{bmatrix} \begin{bmatrix} q_1[n] \\ q_2[n] \end{bmatrix} + \begin{bmatrix} \rho \\ \sigma \end{bmatrix} x[n] \\ &= \mathbf{A}\mathbf{q}[n] + \mathbf{b}x[n]. \end{aligned}$$

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Spring 2018

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