Example 6.39 (Communication channel equalization)**.** Consider a LTI communication channel with frequency response

$$H(\omega) = \tfrac{1}{3+j\omega}.$$

Unfortunately, this channel has the undesirable effect of attenuating higher frequencies. Find the frequency response G of an equalizer that when connected in series with the communication channel yields an ideal (i.e., distortionless) channel. The new system with equalization is shown in Figure 6.24, where g and h denote the inverse Fourier transforms of G and H, respectively.

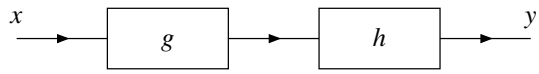

Figure 6.24: System from example that employs equalization.

Solution. An ideal communication channel has a frequency response equal to one for all frequencies. Consequently, we want $H(\omega)G(\omega) = 1$ or equivalently $G(\omega) = 1/H(\omega)$. Thus, we conclude that

rearrange

$$\begin{aligned} G(\omega) &= \frac{1}{H(\omega)} \\ &= \frac{1}{\left(\frac{1}{3+j\omega}\right)} \\ &= 3 + j\omega. \end{aligned}$$

Substitute given H

simplify

■