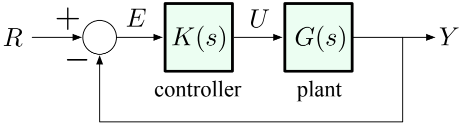
Approximate PD Using Dynamic Compensation



Closed-loop poles: $1 + \left(K_{\mathrm{P}} + K_{\mathrm{D}}\frac{ps}{s+p}\right)G(s) = 0$

Transform into Evans' canonical form:

$$\begin{aligned} K_{\mathrm{P}} + K_{\mathrm{D}}\frac{ps}{s+p} &= \frac{(K_{\mathrm{P}} + pK_{\mathrm{D}})s + pK_{\mathrm{P}}}{s+p} \\ &= (K_{\mathrm{P}} + pK_{\mathrm{D}}) \cdot \frac{s + \frac{pK_{\mathrm{P}}}{K_{\mathrm{P}}+pK_{\mathrm{D}}}}{s+p} \end{aligned}$$

Thus, we can write the controller as $K \cdot \frac{s+z}{s+p}$, where:

- the parameter $K = K_{\mathrm{P}} + pK_{\mathrm{D}}$ is a combination of P-gain, D-gain, and p
- the controller has an open-loop zero at $-z = -\frac{pK_{\mathrm{P}}}{K}$