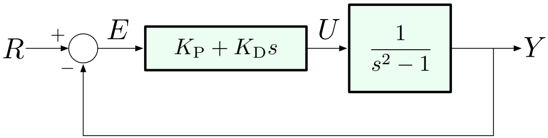
# Proportional-Derivative (PD) Control




$$\frac{Y}{R} = \frac{\dfrac{K_P + K_D s}{s^2 - 1}}{1 + \dfrac{K_P + K_D s}{s^2 - 1}} = \frac{K_P + K_D s}{s^2 + K_D s + K_P - 1}$$

— now, if we set $K_D > 0$ and $K_P > 1$, then the transfer function will be stable.

Even more: by choosing $K_P$ and $K_D$, we can *arbitrarily* assign coefficients of the denominator, and therefore the poles of the transfer function:

PD control gives us arbitrary pole placement!!