Modelling and control summaries

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Offset 6 – offset with output disturbance

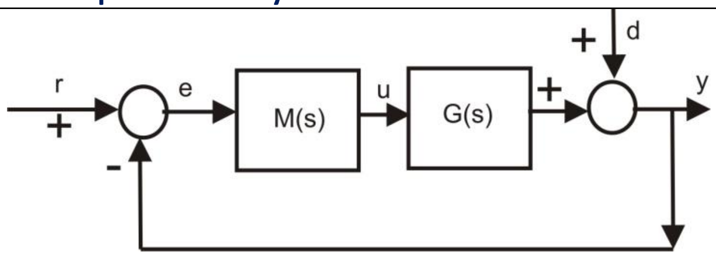
CLOSED-LOOP SYSTEM STEADY-STATE OFFSET TO OUTPUT DISTURBANCES

The aim is to totally reject disturbances so the dependence of y on d should ➔0

Assume that the loop input d(t) is constant and ignore r(t).

$$y=\underbrace{\left(\frac{1}{1+GM}\right)}_{G_c}d;\quad e=\underbrace{\left(\frac{-1}{1+GM}\right)}_{G_{ce}}d$$

$$offset=\lim_{s\to 0}\frac{-1}{1+G(s)M(s)}$$



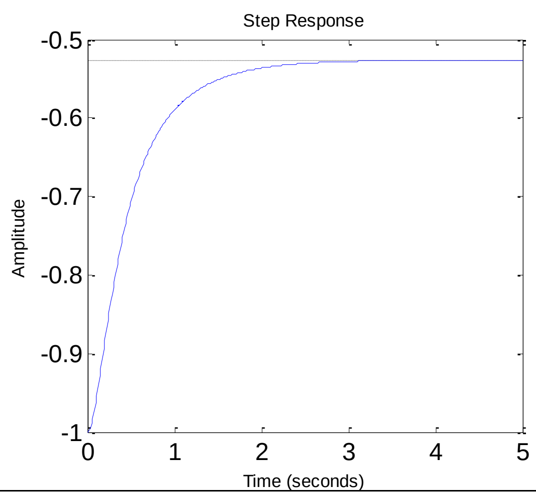
THIS FORMULAE IS THE SAME AS FOR TRACKING, EXCEPT FOR THE SIGN, AND THUS ALL THE SAME INSIGHTS FROM OFFSET4 WILL FOLLOW.

SUMMARY: In order to reject output disturbances, there must be an integrator in either the compensator M(s) or the system G(s). Obviously, it is also required that the loop is stable.

EXAMPLE 1: Find the steady-state offset for the following systems (remember you also need to verify that all the poles are in the LHP) when subject to a unit output disturbance

$$G=\frac{2}{(s+1)(s+4)};\quad M(s)=6\frac{s+3}{s+10}$$

$$offset=\frac{-1}{1+G(0)M(0)}=\frac{-1}{1+0.9}\approx -0.52$$



$$G=\frac{2}{s(s+1)(s+4)};\quad M(s)=6\frac{s+3}{s+10}$$

$$offset=0$$

ZERO offset but slower convergence with the integrator