PREPARATION: Before you start, summarise the key observations and rules for Nyquist diagrams and stability criteria.

For the loop above, the full definition of a Nyquist diagram is the mapping of \( G(s)M(s) \) while \( s \) describes the \( D \)-contour. **Note**, using the loop transfer function \( GM \) and not \( GM/(1+GM) \)!

Always check against root-loci or other technique to ensure consistency.

Closed-loop stable iff \( n_c=0 \)!

Apply the Nyquist stability criteria to assess the closed-loop stability and stability dependence on compensator gain (assume \( M(s)=K \)) for the following examples. Use MATLAB to test your answers. Compare your insights with those gained from root-loci and verify your results with the closed-loop step response plots.

\[
G = \frac{10(s + 0.1)}{(s - 1)(s + 2)}
\]

\[
G = \frac{400(s + 4)(s + 20)}{s^2(s + 1)(s + 100)}
\]

\[
G = \frac{14s + 60}{s(s + 1)(s + 2)(s + 5)}
\]

\[
G(s) = \frac{3}{s^2(s + 2)}
\]

\[
G(s) = \frac{3}{s(s + 2)(s + 3)}
\]

\[
G(s) = \frac{5}{(s - 1)(s + 2)(s + 3)}
\]

\[
G = \frac{0.5}{(s - 1)}; \quad M = 1 \quad \text{or} \quad M = 4 \frac{(s + 1)}{s}
\]

\[
G = \frac{1}{s(s + 1)}; \quad M = 1 \quad \text{or} \quad \frac{(s + 1)}{(s + 10)} \quad \text{or} \quad \frac{(s + 10)}{(s + 1)}
\]