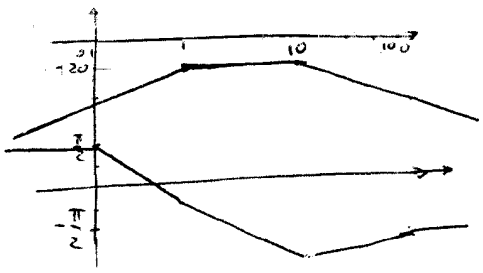
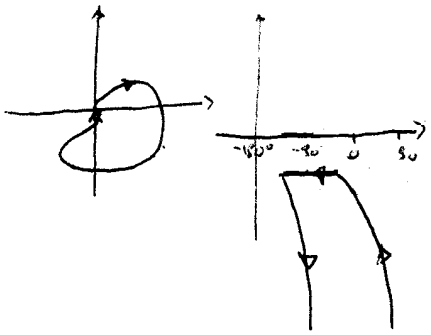
FONDAMENTI/PRINCIPI DI AUTOMATICA - 4/2/10

1) $G(s) = \dfrac{s(1-s)}{10\left(1-\frac{s}{10}\right)(1+s+s^2)}$





NON ASINTOTICAMENTE STABILE

2) $G(s) = \dfrac{s+5}{s^2+2s+1}$

a) $\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & -2 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u$

$y = \begin{pmatrix} 5 & 1 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$

b) $u = 2 \sin(3t+0.1)$ $\quad |G(j3)| = 0,58$ $\quad \angle G(j3) = -1,96$ $\quad y = 2 \cdot 0.58 \sin(3t + 0.1 - 1,96)$

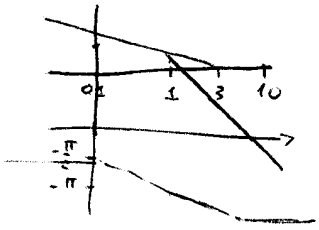
c) $u(t) = t \cdot 1(t) - (t-1)1(t-1) - 1(t-1)$

risposta al gradino $Y_g(s) = \dfrac{s+5}{s(s+1)^2} = \dfrac{5}{s} - \dfrac{4}{(s+1)^2} - \dfrac{5}{(s+1)}$ $\quad y_g(t) = \left[5 - 5e^{-t} - 4te^{-t}\right]1(t)$

risposta alla rampa $Y_2(s) = \dfrac{s+5}{s^2(s+1)^2} = -\dfrac{9}{s} + \dfrac{5}{s^2} + \dfrac{9}{(s+1)} + \dfrac{4}{(s+1)^2}$ $\quad y_2 = \left[5t - 9 + 9e^{-t} + 4te^{-t}\right]1(t)$

$y(t) = y_2(t) - y_2(t-1) - y_g(t-1)$

3) $C(s) = \dfrac{K_c}{s}$. Si pone $K_c = 1$, $F(s) = \dfrac{3}{s(s+1)^2}$



Si deve abbassare il guadagno. Al max $K_c = 0.1$ va bene.

4) $\hat{A} = e^{AT_s} = e^{-2 \cdot 0.1} = 0.8187$

$\hat{B} = A^{-1}\left(e^{AT_s} - I\right)B = \dfrac{\left(e^{-2 \cdot 0.1} - 1\right) \cdot 2}{-2} = 0.1813$

$\hat{C} = C$

$\Rightarrow \begin{cases} x(k+1) = 0.8187\,x(k) + 0.1813\,u(k) \\ y(k) = 4\,x(k) \end{cases}$

ASINTOTICAMENTE STABILE ($0.8187 < 1$)

$x_e = 0.8187\,x_e + 0.1813 \cdot 2$

$x_e = 2$