Prob 4

(b) If $\underbrace{|W_1 S V(j\omega)|^2}_{\text{dominates at low freq}} + \underbrace{|W_2 U V(j\omega)|^2}_{\text{dominates at high freq}} \approx \gamma^2$,

then

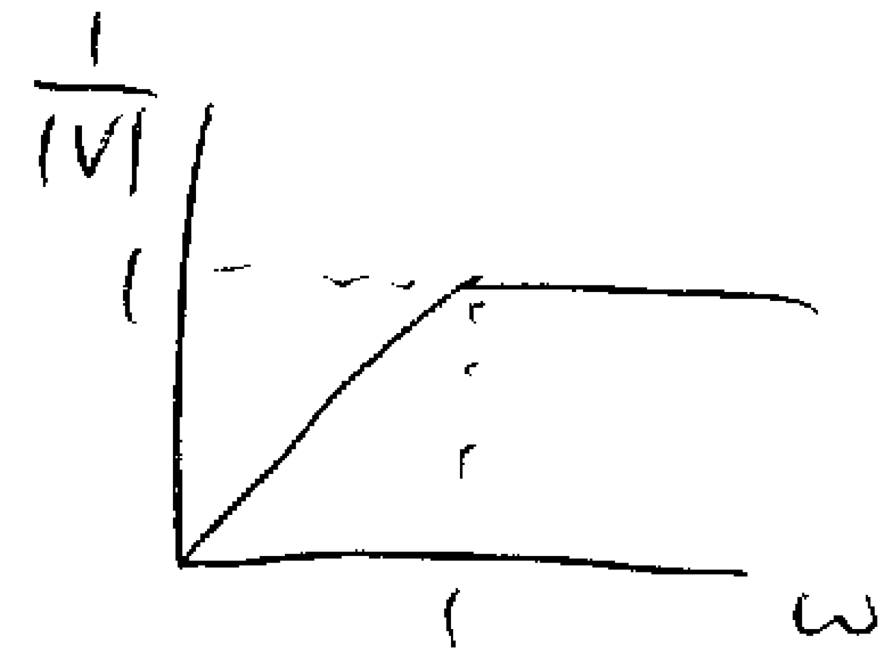
$$|S(j\omega)| \approx \frac{\gamma}{|W_1 V(j\omega)|} \quad \text{for } \omega \text{ small}$$

$$|U(j\omega)| \approx \frac{\gamma}{|W_2 V(j\omega)|} \quad \text{for } \omega \text{ large}$$

In this example,

$$|S(j\omega)| \approx \frac{\gamma}{|V(j\omega)|}$$

↳ very good low freq behavior.



If $r=0$, then $W_2 = c$. $|U(j\omega)| \approx \dfrac{\gamma}{c\,|V(j\omega)|}$

↳ Controller $K \approx$ const. at high freq

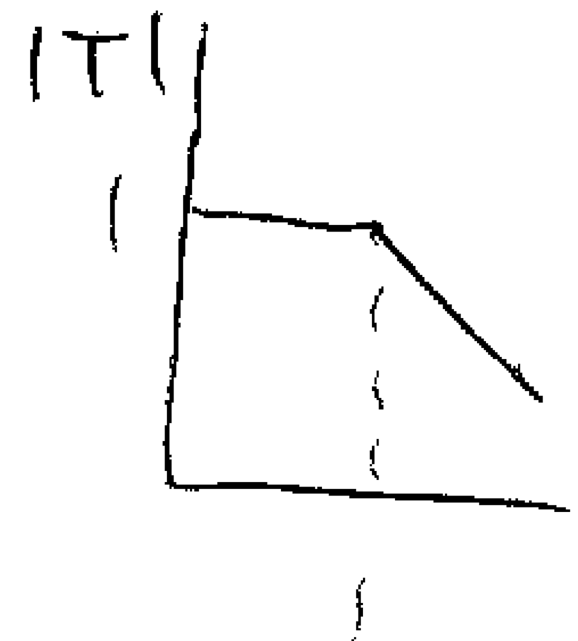
$$|T| = |PK(I+PK)^{-1}| \approx \frac{\gamma}{c} \cdot \frac{1}{\omega^2} \quad \text{at high freq.}$$

↳ rolls off at 40dB/decade.

If $r \neq 0$, then $W_2 \approx cr\omega$ at high freq.

$$|T| \approx \frac{\gamma}{cr\omega} \cdot \frac{1}{\omega^2} \quad \text{at high freq}$$

↳ rolls off at 60dB/decade.



(c)

Matlab Code

```
c = 0.1;
A = [ 0 0 ; 1 0 ];
B1 = [ 1 ; sqrt(2)];
B2 = [ 1 ; 0 ];
C1 = [ 0 1 ; 0 0 ];
C2 = [ 0 -1 ];
D11 = [ 1 ; 0 ];
D12 = [ 0 ; c ];
D21 = -1;
D22 = zeros(1,1);

P = ss(A,[ B1 B2 ], [ C1 ; C2 ], [ D11 D12 ; D21 D22 ]);
sys = pck(A,[ B1 B2 ], [ C1 ; C2 ], [ D11 D12 ; D21 D22 ]);

[K,CL,GAM] = hinfsyn(P,1,1,0,2,0.01);
```

다음은 위의 코드를 실행한 결과로, bisection algorithm 이 적용된 순서를 볼수있다.

```
Resetting value of Gamma min based on D_11, D_12, D_21 terms

Test bounds:      1.0000 <  gamma  <=     2.0000

  gamma    hamx_eig   xinf_eig    hamy_eig   yinf_eig    nrho_xy   p/f
  2.000    2.4e+000   2.5e-001    7.1e-001   0.0e+000    0.0000    p
  1.500    2.6e+000   2.8e-001    7.1e-001  -3.7e-017    0.0000    p
  1.250    2.9e+000  -8.4e+001#   7.1e-001   0.0e+000    0.0000    f
  1.375    2.7e+000   2.9e-001    7.1e-001   0.0e+000    0.0000    p
  1.313    2.8e+000   3.0e-001    7.1e-001   0.0e+000    0.0000    p
  1.281    2.8e+000  -6.5e+002#   7.1e-001   0.0e+000    0.0000    f
  1.297    2.8e+000   3.0e-001    7.1e-001   0.0e+000    0.0000    p
  1.289    2.8e+000   3.1e-001    7.1e-001   0.0e+000    0.0000    p

Gamma value achieved:      1.2891
```

bisection