1. 2-DOF PP Control of an IBM Lotus Domino Server

T.F. between Max_users and no. of remote procedure calls:

$$G(z) = \frac{0.47z^{-1}}{1 - 0.43z^{-1}}$$

Track step inputs with Rise time $\leq$ 10, overshoot $\varepsilon \leq 0.1$.

$$\begin{aligned} A^g &= 1 - 0.43z^{-1} \\ A^b &= 1 \\ B^g &= 0.47 \\ B^b &= 1 \\ k &= 1 \end{aligned}$$

$$\begin{aligned} T_s &= 1 \\ N_r &= 10 \\ \omega &= 0.1571 \\ \rho &= 0.7943 \\ \phi_{cl} &= 1 - 1.5691z^{-1} + 0.6310z^{-2} \\ A^b \Delta R_1 + z^{-k} B^b S_1 &= \phi_{cl} \end{aligned}$$

2. 2-DOF PP Control of an IBM Lotus Domino Server

$$(1 - z^{-1})R_1 + z^{-1}S_1 = 1 - 1.5692z^{-1} + 0.6310z^{-2}$$

The solution is given by,

$$\begin{aligned} R_1 &= 1 - 0.6310z^{-1} \\ S_1 &= 0.0619 \end{aligned}$$

and the 2-DOF pole placement controller is given by,

$$\begin{aligned} R_c &= 0.47 - 0.7665z^{-1} + 0.2965z^{-2} \\ S_c &= 0.0619 - 0.0266z^{-1} \\ T_c &= 1 - 0.43z^{-1} \\ \gamma &= 0.0619 \end{aligned}$$

3. ibm_pp.m

```
% Control of IBM lotus domino server
% Transfer function
B = 0.47; A = [1 -0.43]; k = 1;
[zk,dzk] = zpowk(k);

% Transient specifications
rise = 10; epsilon = 0.01; Ts = 1;
phi = desired(Ts,rise,epsilon);

% Controller design
delta = 1; % internal model of step used
[Rc,Sc,Tc,gamma,F] = pp_im(B,A,k,phi,delta);

% Simulation parameters for stb_disc
st = 1; % desired change
t_init = 0; % simulation start time
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t_final = 50; % simulation end time
C = 0; D = 1; N_var = 0;
```
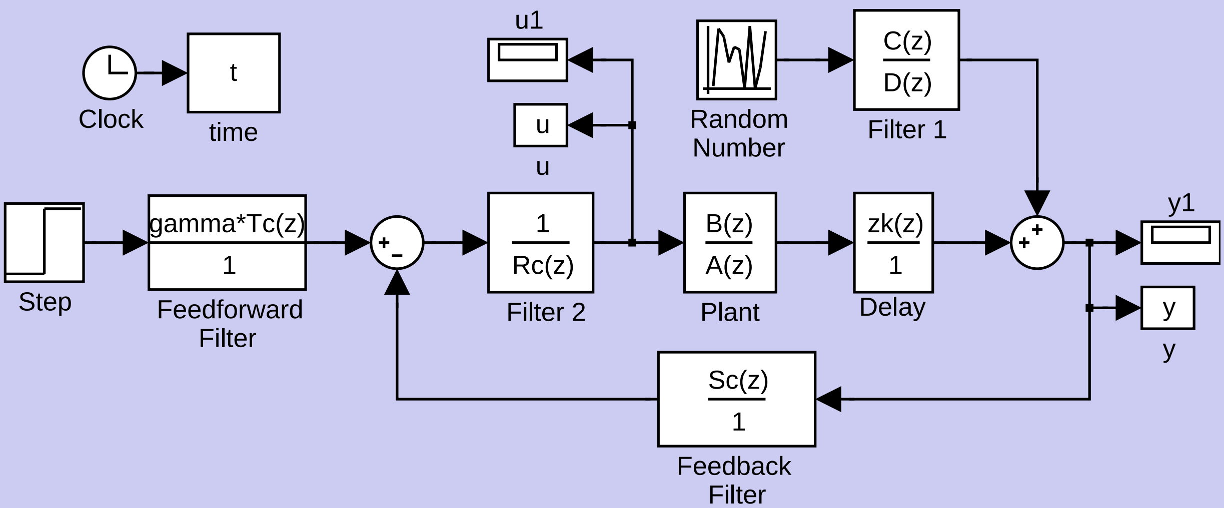
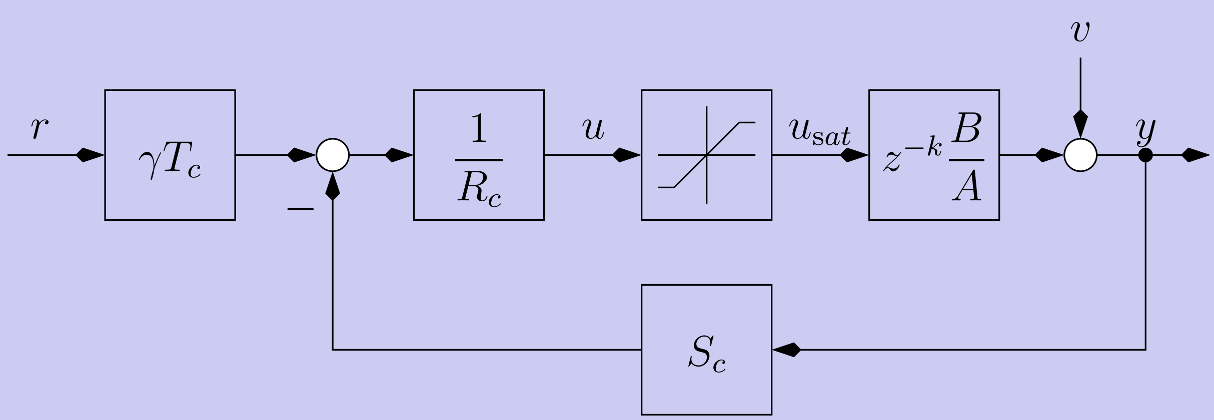
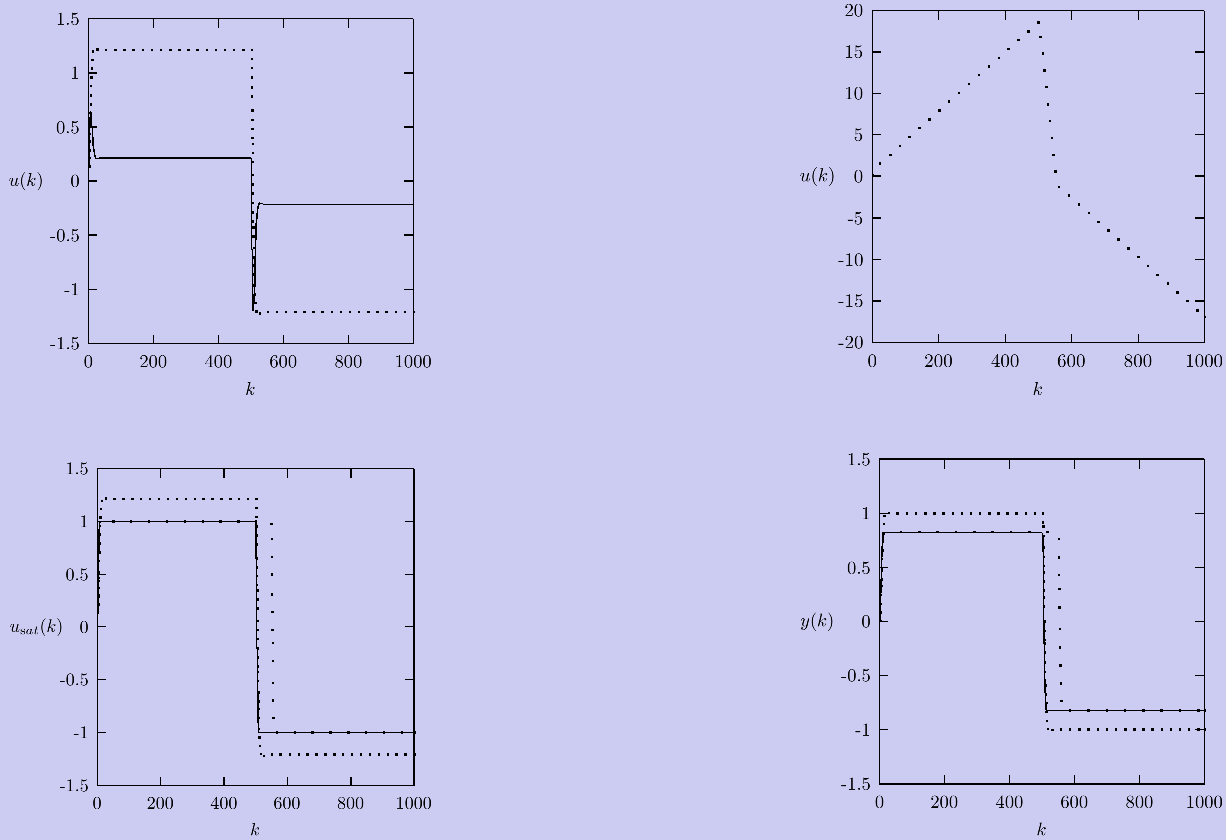

4. stb_disc.mdl



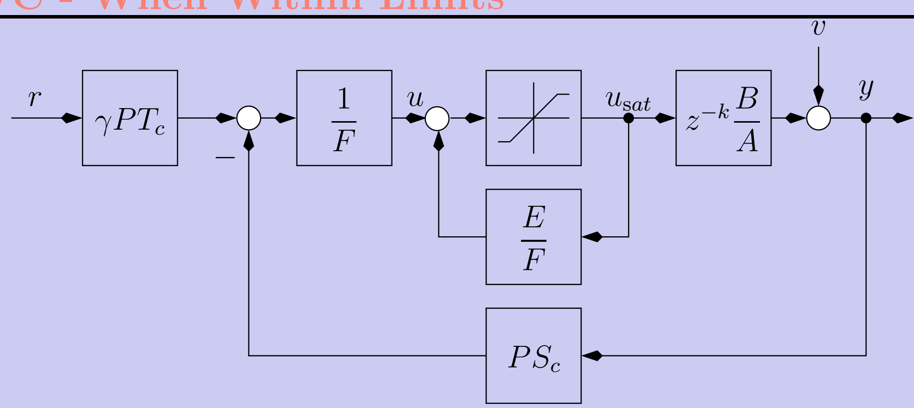
5. Saturation Block



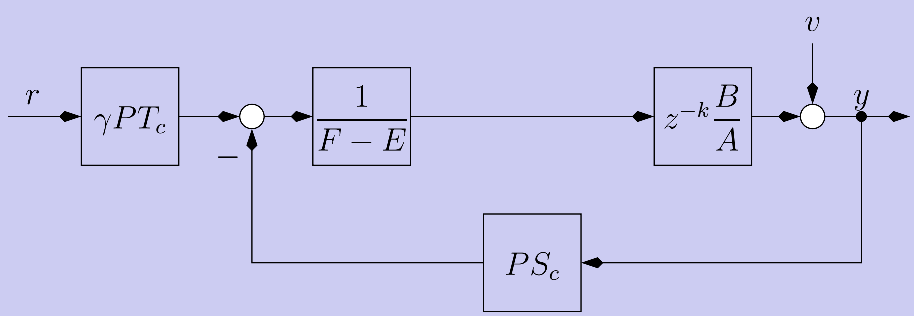
6. Saturation Block Simulation Results



7. AWC - When Within Limits

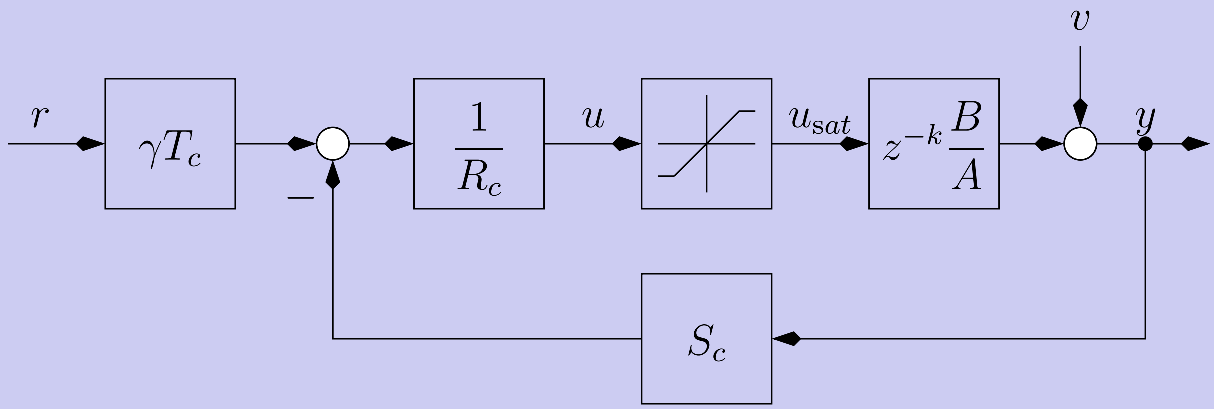


When within limits,

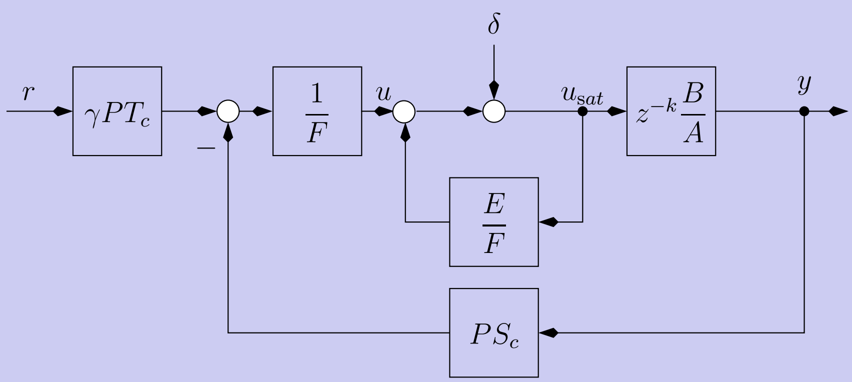


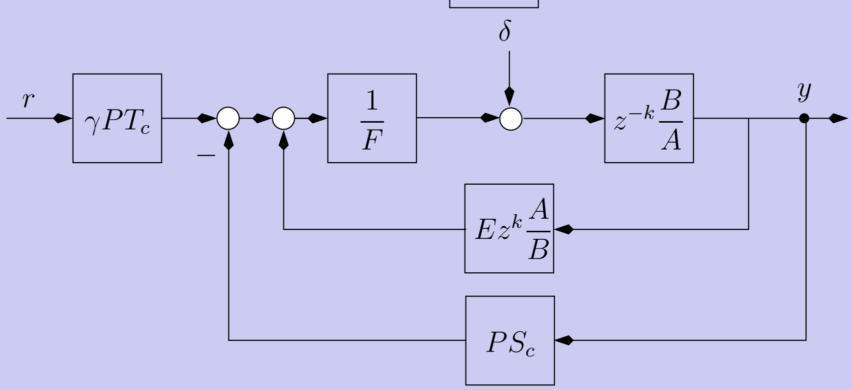
Choose $F - E = PR_c$

8. AWC



9. AWC - When Limits are Exceeded





10. Performance of AWC

$$T_{\delta y} = \frac{z^{-k}\frac{B}{A}}{1 + z^{-k}\frac{B}{A}\left(PS_c - Ez^k\frac{A}{B}\right)\frac{1}{F}} = \frac{z^{-k}BF}{FA + (z^{-k}BPS_c - EA)}$$

Using $F - E = PR_c$,

$$T_{\delta y} = \frac{z^{-k}BF}{PR_cA + z^{-k}BPS_c}$$

If we choose $F = AR_c + z^{-k}BS_c = \phi_{cl}A^gB^g$

$$T_{\delta y} = z^{-k}\frac{B}{P}$$

If P well behaved, the effect of $T_{\delta y}$ will diminish with time. A popular choice, when A is Hurwitz is

$$P = A$$

11. Saturation Block Simulation Results