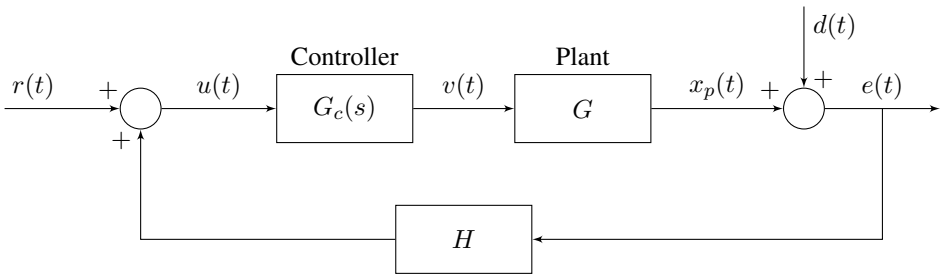
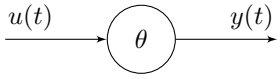
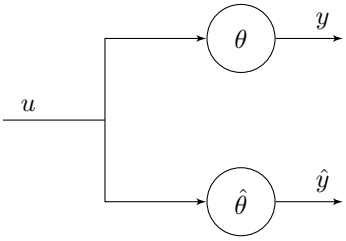
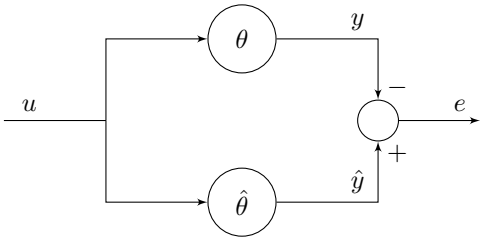
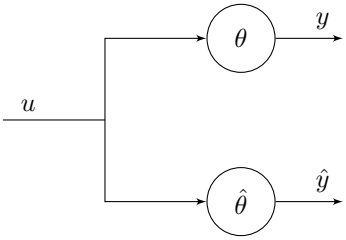
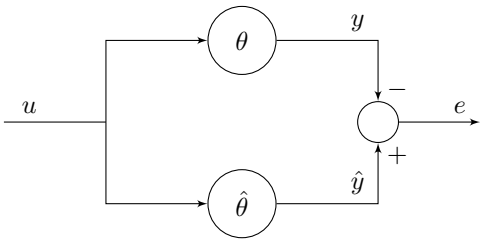

Controller
Plant
$r(t)$
$+$
$+$
$u(t)$
$G_c(s)$
$v(t)$
G
$x_p(t)$
$d(t)$
$+$
$+$
$e(t)$
H

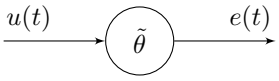

$u(t)$
θ
$y(t)$

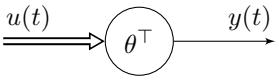

θ
y
u
$\hat{\theta}$
$\hat{y}$

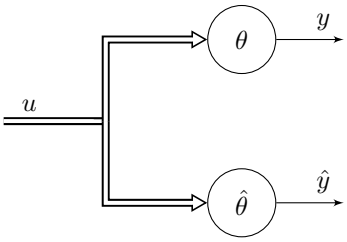

θ
y
$-$
u
e
$+$
$\hat{y}$
$\hat{\theta}$

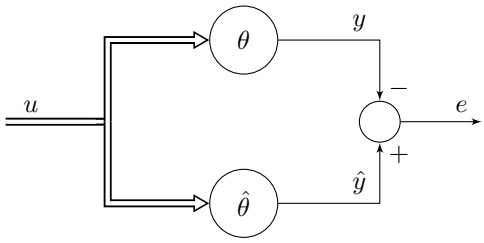

θ
y
u
$\hat{\theta}$
$\hat{y}$

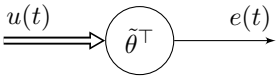

θ
y
u
$-$
e
$+$
$\hat{y}$
$\hat{\theta}$

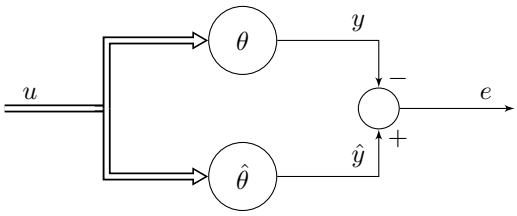

$u(t)$
$\tilde{\theta}$
$e(t)$

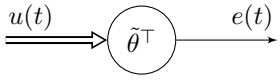

$u(t)$
$\theta^\top$
$y(t)$

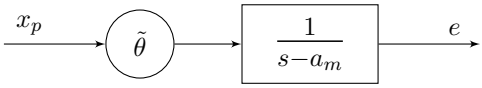

θ
y
u
$\hat{y}$
$\hat{\theta}$

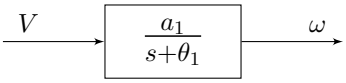

θ
y
u
$-$
e
$+$
$\hat{y}$
$\hat{\theta}$

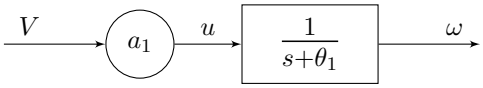

$u(t)$
$\tilde{\theta}^\top$
$e(t)$

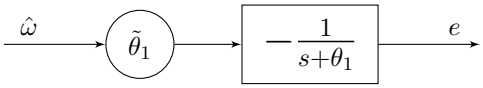

θ
y
u
$-$
e
$+$
$\hat{y}$
$\hat{\theta}$

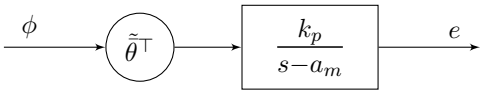

$u(t)$
$\tilde{\theta}^\top$
$e(t)$

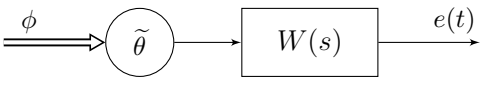

x_p
$\tilde{\theta}$
$\frac{1}{s-a_m}$
e

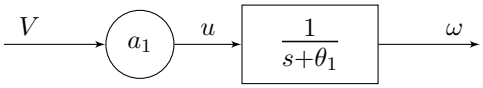

V
$\frac{a_1}{s+\theta_1}$
ω

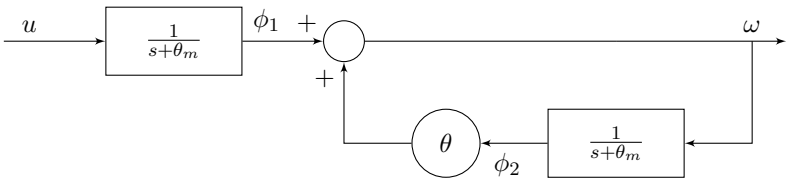

V
a_1
u
$\frac{1}{s+\theta_1}$
ω

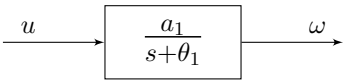

$\hat{\omega}$
$\tilde{\theta}_1$
$-\frac{1}{s+\theta_1}$
e

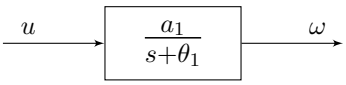

ϕ
$\tilde{\theta}^\top$
$\frac{k_p}{s-a_m}$
e

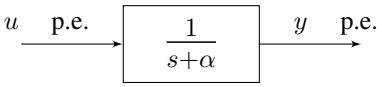

ϕ
$\widetilde{\theta}$
$W(s)$
$e(t)$

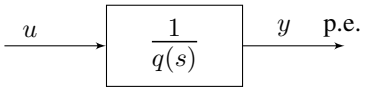

V
a_1
u
$\frac{1}{s+\theta_1}$
ω

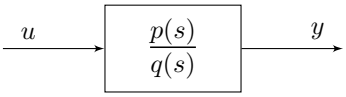




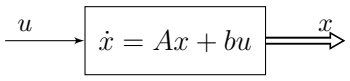


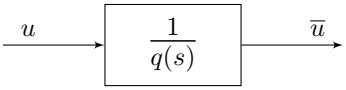


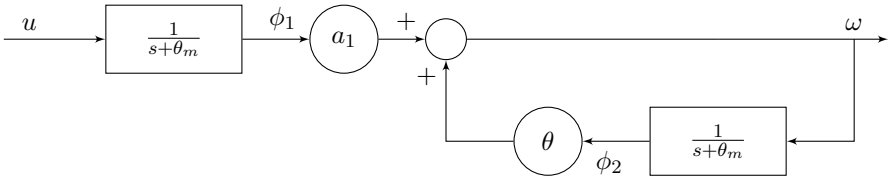


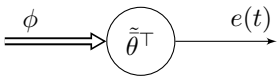


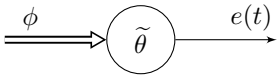
$p(s)$ $q(s)$ Hurwitz proper t.f.

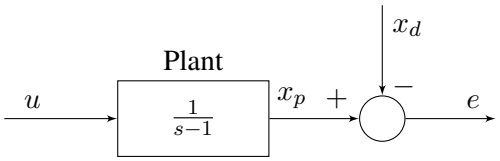


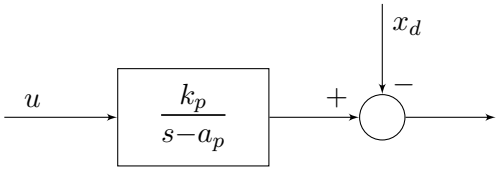


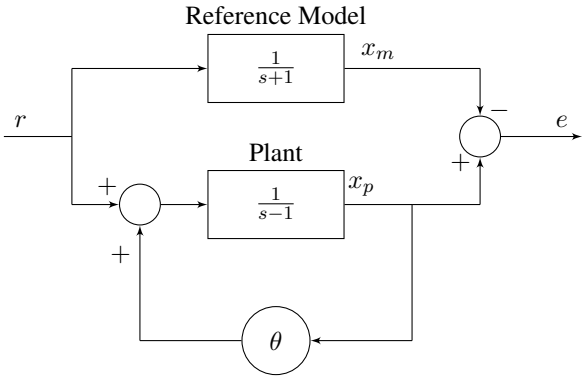

u
$\frac{1}{s+\theta_m}$
ϕ_1
a_1
$+$
$+$
ω
θ
ϕ_2
$\frac{1}{s+\theta_m}$

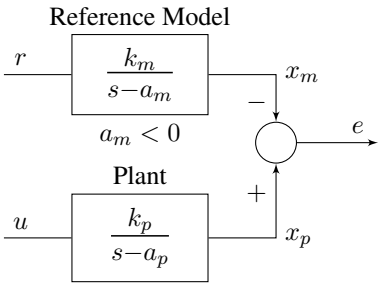

ϕ
$\tilde{\theta}^\top$
$e(t)$

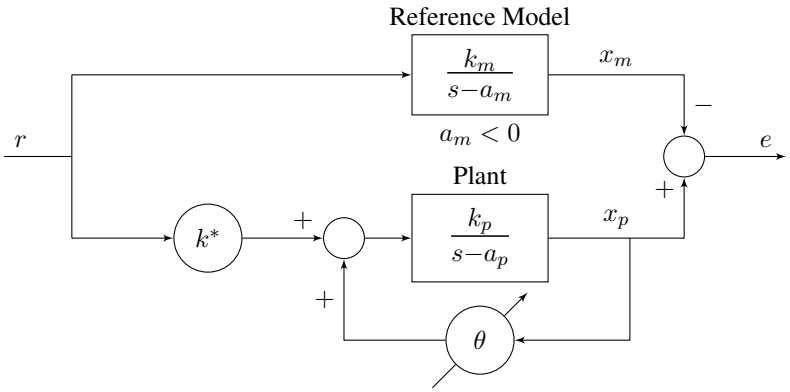

ϕ
$\tilde{\theta}$
$e(t)$

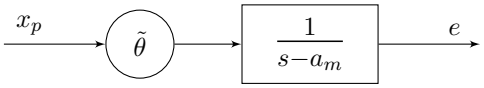

Plant
x_d
u
$\frac{1}{s-1}$
x_p
$+$
$-$
e

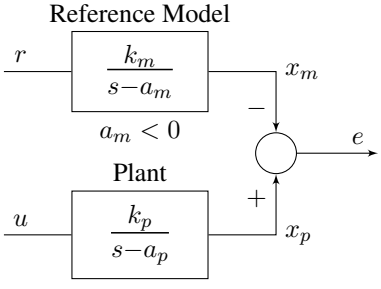

x_d
u
$\frac{k_p}{s-a_p}$
$+$
$-$


Reference Model
$\frac{1}{s+1}$
x_m
r
$-$
e
Plant
$+$
$\frac{1}{s-1}$
x_p
$+$
$+$
θ


Reference Model
r
$\frac{k_m}{s-a_m}$
x_m
−
$a_m < 0$
e
Plant
+
u
$\frac{k_p}{s-a_p}$
x_p


Reference Model
$\frac{k_m}{s-a_m}$
x_m
−
r
$a_m < 0$
e
Plant
+
k^*
+
$\frac{k_p}{s-a_p}$
x_p
+
θ


x_p
$\tilde{\theta}$
$\frac{1}{s-a_m}$
e


Reference Model
r
$\frac{k_m}{s-a_m}$
x_m
−
$a_m < 0$
e
Plant
+
u
$\frac{k_p}{s-a_p}$
x_p

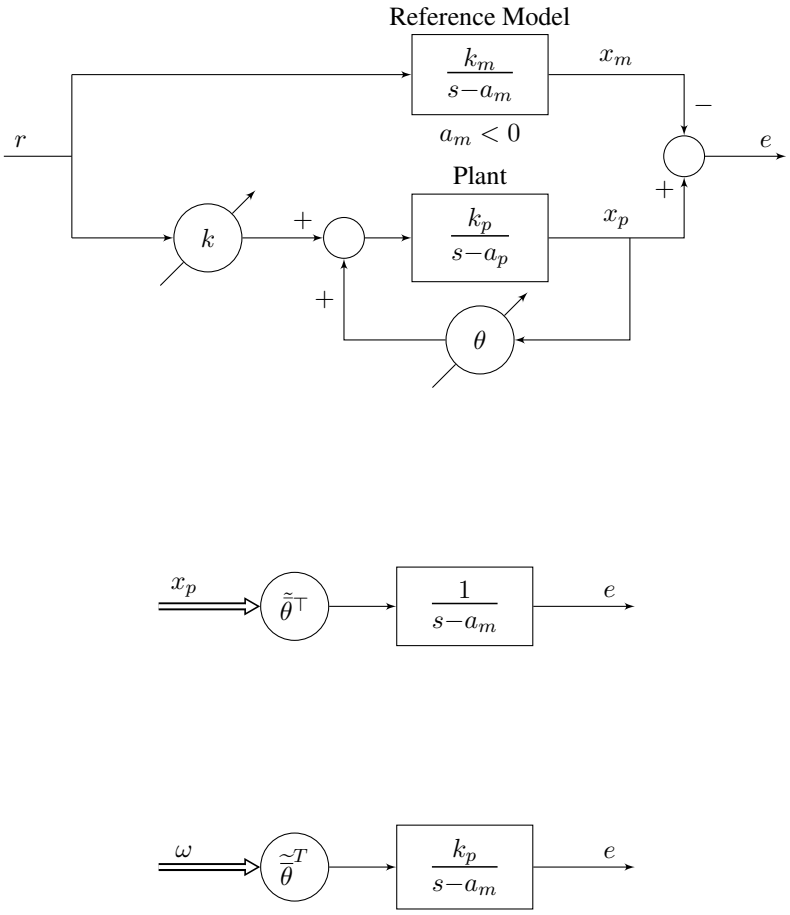
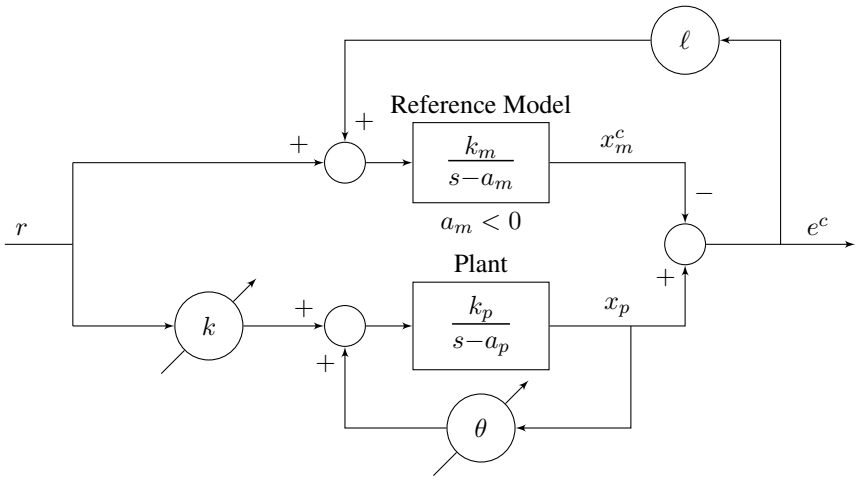
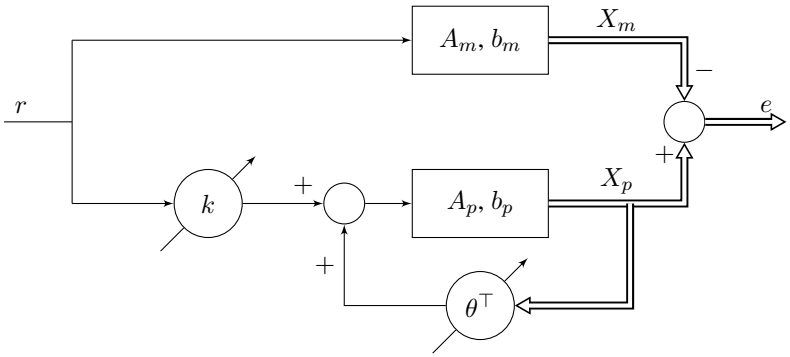
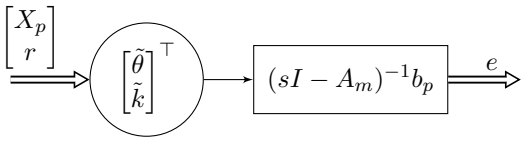
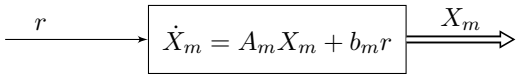


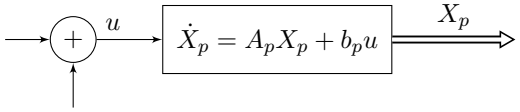
Figure 1: $lec2\ fig13\ and\ lec3\ fig1$

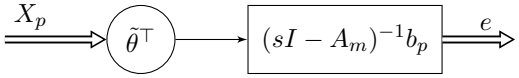




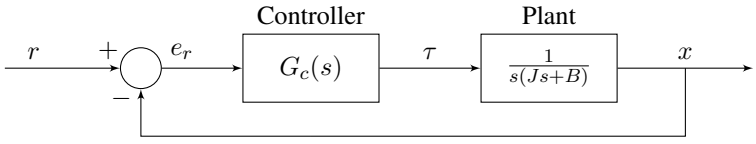


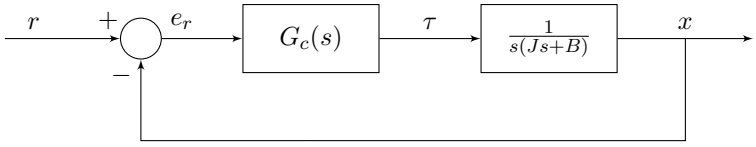


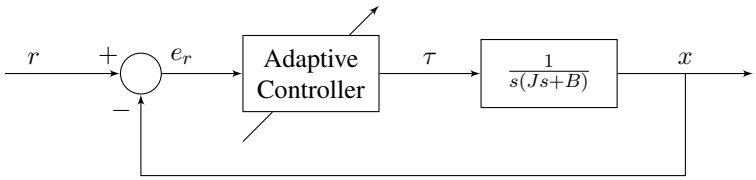


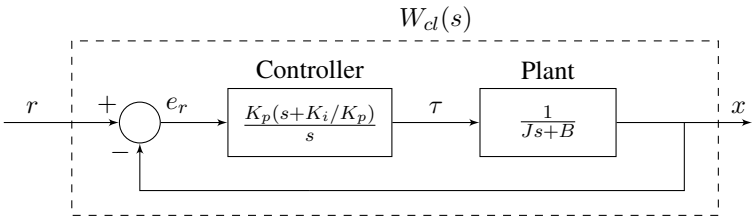


Error Model 2






r
+
−
e_r
Adaptive Controller
τ
$\frac{1}{s(Js+B)}$
x


$W_{cl}(s)$
Controller
Plant
r
+
−
e_r
$\frac{K_p(s+K_i/K_p)}{s}$
τ
$\frac{1}{Js+B}$
x