alpha_t_ref

Step

Sine Wave

Manual Switch

PID(s)

PID Controller

u

u(t)

$\frac{1}{s+6}$

Transfer Fcn

$\frac{1}{s}$

Integrator1

alpha_t

Goto7

U

×

Gain4 .2

alpha_ts

Pm

Tth

d(Ma,in)/dt

alpha(t)

Hth(Pm,d(Ma ,in)/dt ,alpha (t))

Pm

alpha(t)

M'a,in

F(Pm,alpha (t))

(Vm/R*thetam)^-1

-K-

$\frac{1}{s}$

Integrator

Pmdot

Goto1

Pm

Goto2

M'ac

Pm

n

G(Pm,n)

12.5 Constant

0

Gain3

×

p_ms

Goto4

Pms

P m,s

0

Gain2

×

Mains

Group 1

Signal 2

Signal Builder

Gain1 0

×

alphats

Goto3

Main

Residual 1 r1

Residual1

Residual 2 r2

Residual2

Residual 3 r3

Residual3

Residual 4 r4

Residual4

Residual 5 r5

Residual5

Residual 6 r6

Residual6

RESIDUALS

Hth

1

1

Pm

$\pm\sqrt{|u|}$

Signed Sqrt

3

alpha(t)

u^2

$\pm\sqrt{|u|}$

Signed Sqrt1

2

d(Ma,in)/dt

$\pm\sqrt{|u|}$

Signed Sqrt3

×

×

×

×

+
+
+
+
+
+
+
+

1

Tth

F

1

2
alpha(t)

u^2

u(1)^3

Fcn

×

1
Pm

+
+
+
+
+
+

1
M'a,in

G

1

2
n
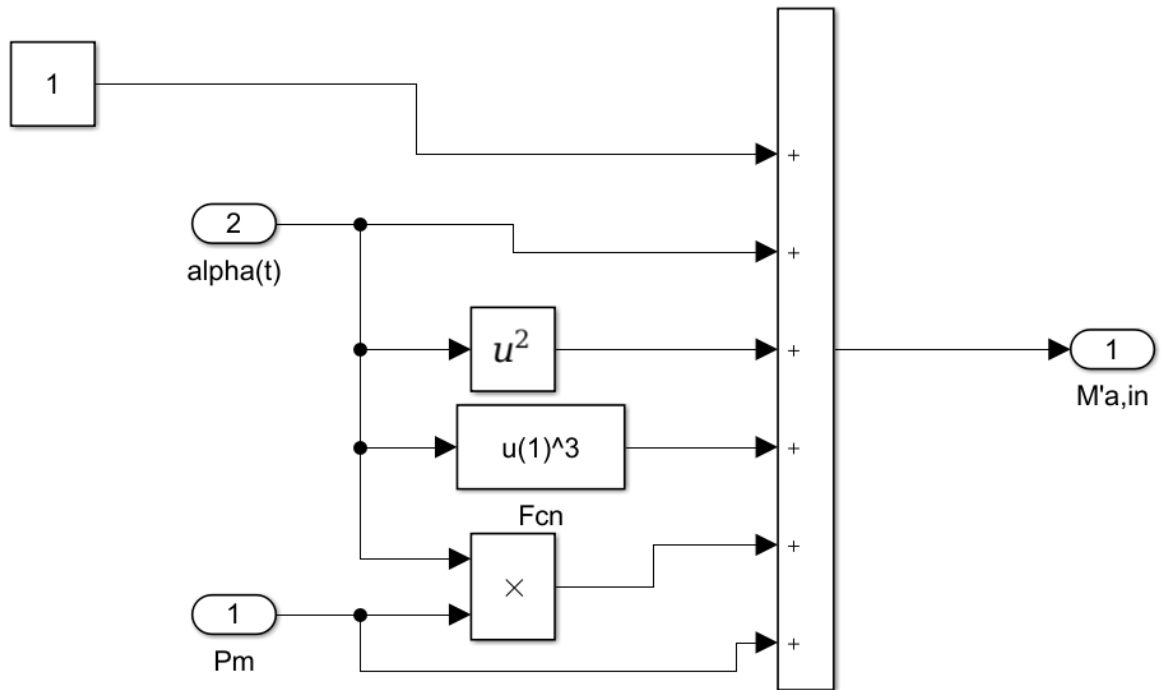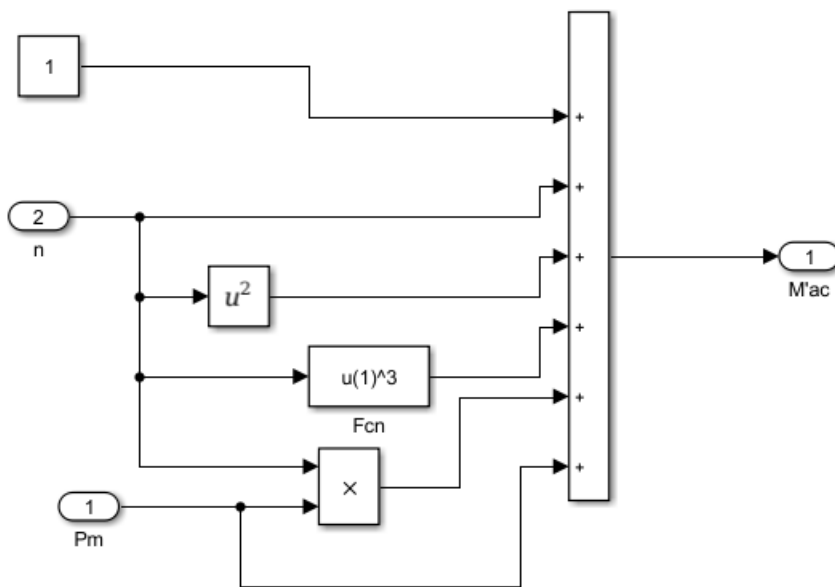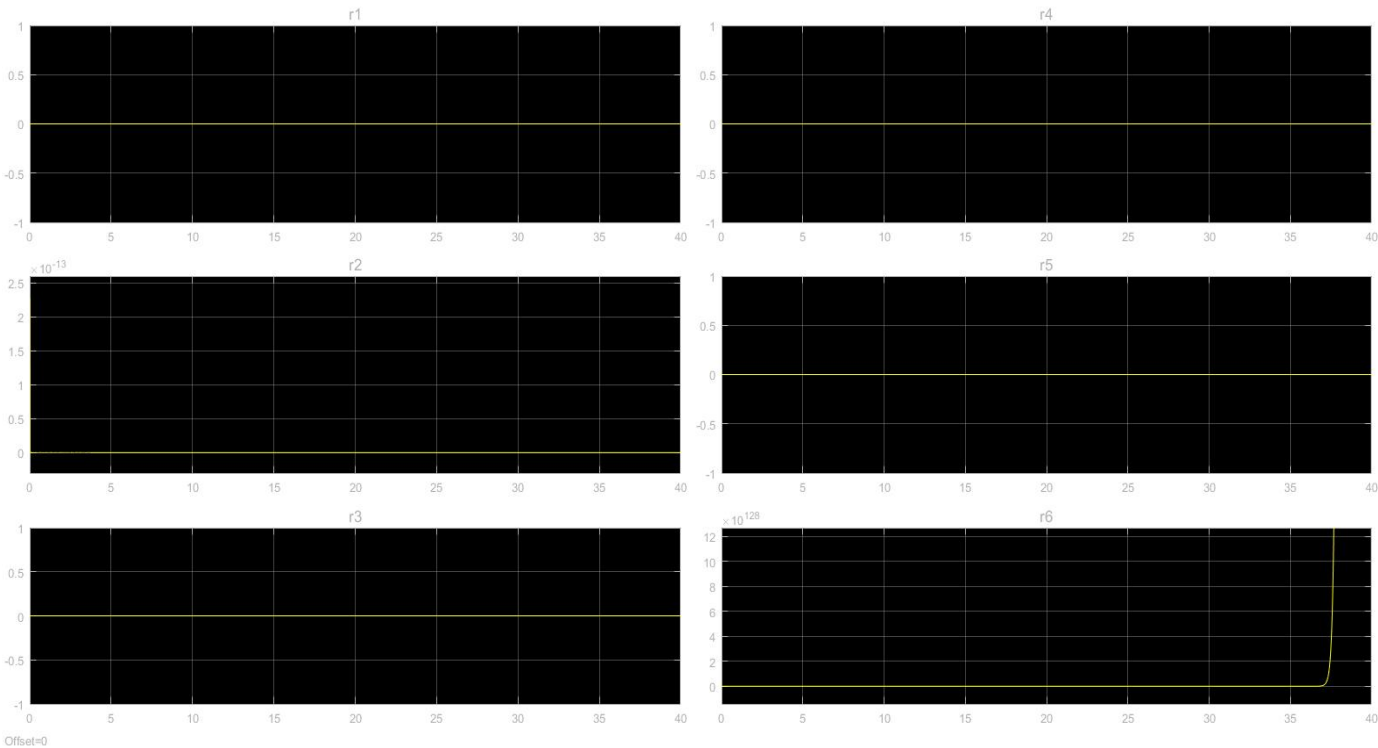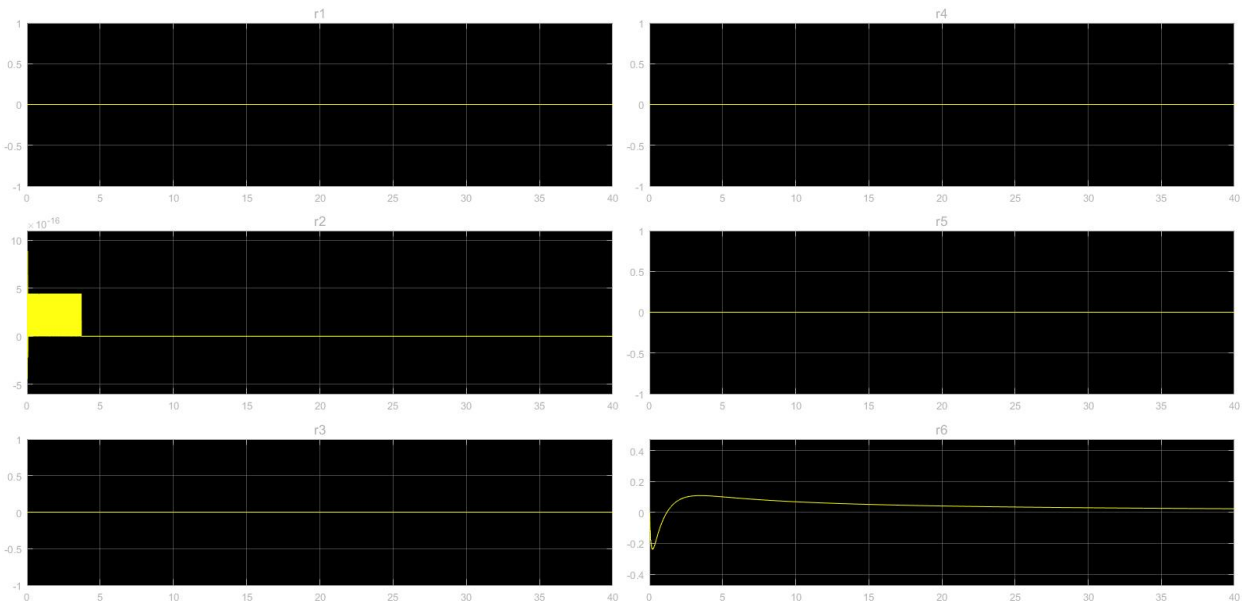
u^2

u(1)^3

Fcn

×

1
Pm

+
+
+
+
+
+

1
M'ac

Residuals at zero fault (@ residual 6: A=8)

Residuals at zero fault (@ residual 6: A=-10)

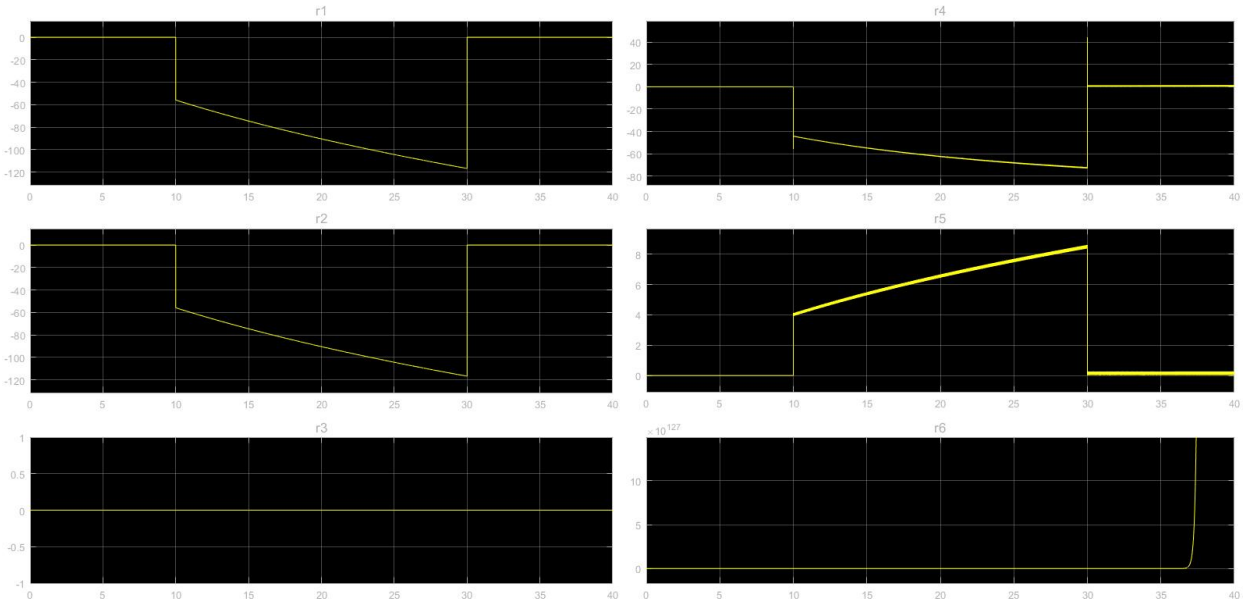## PID controller is tuned using Simulink built-in tuner:

Controller parameters

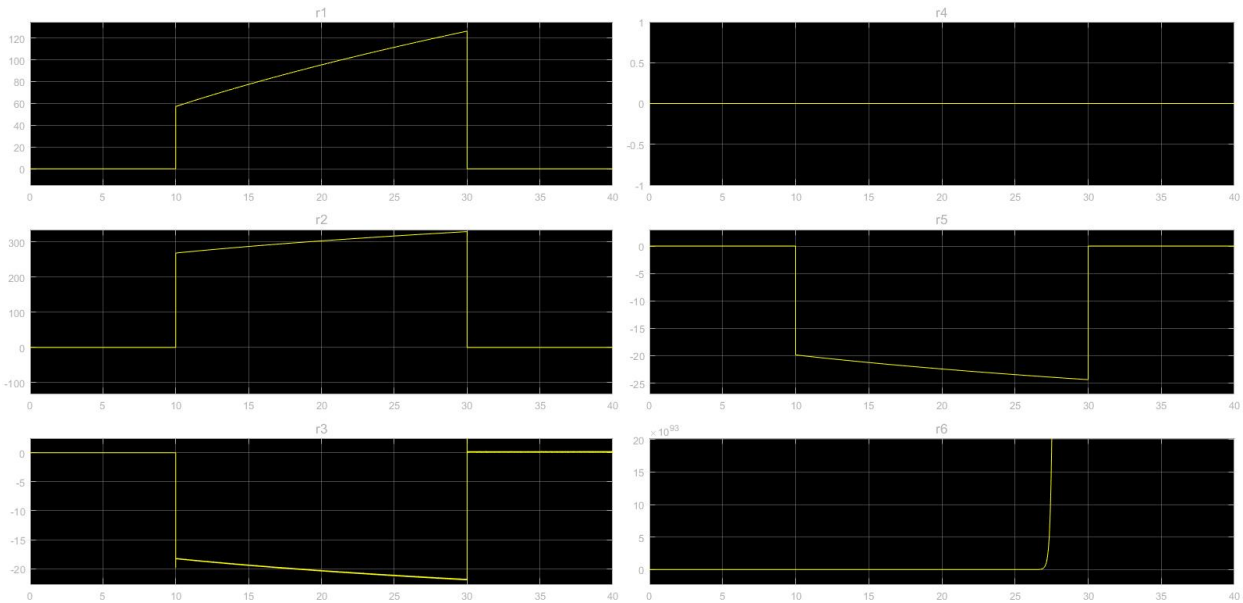|	
Source:	internal
Proportional (P):	233.054822677898
Integral (I):	587.459323889785
Derivative (D):	22.5964910493758
Filter coefficient (N):	2745.99038877462

Residuals at 20% actuator fault:
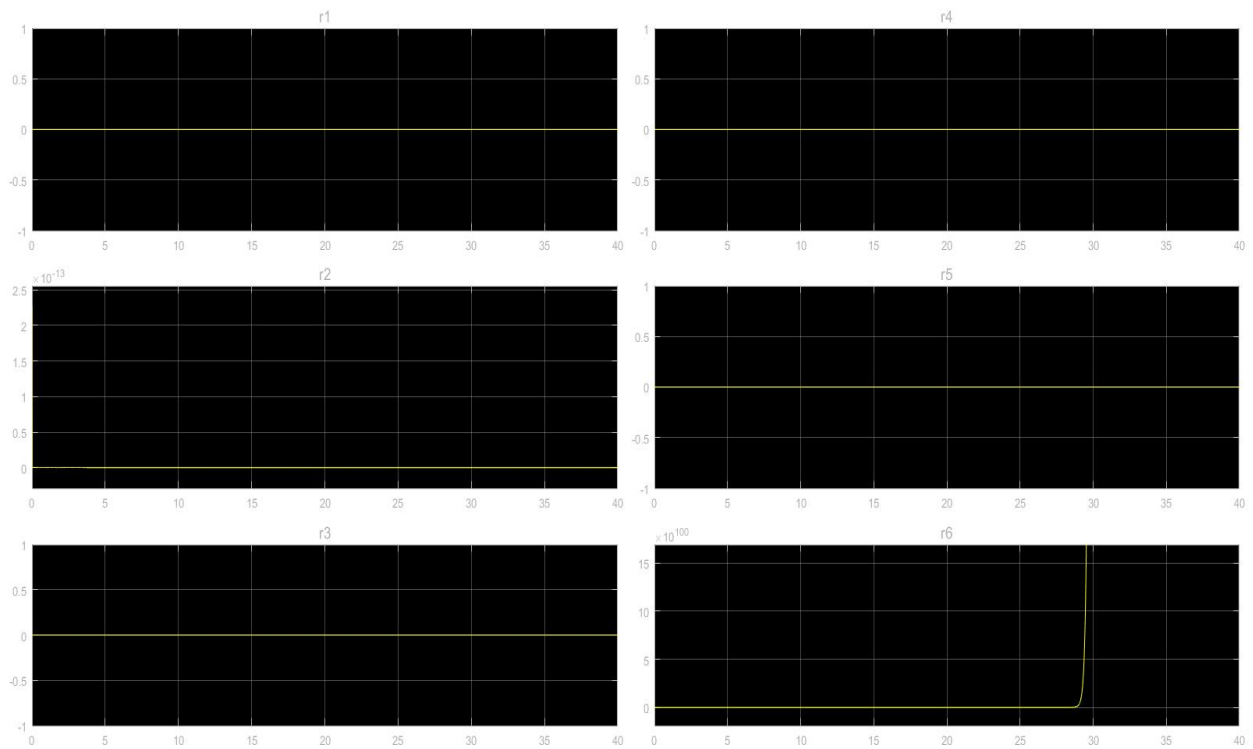
Residuals at 10% air fuel mass fault:

Residuals at 10% pressure fault:

Residuals at 10% throttle fault: