# PID       ?

PID      (Proportional),      (Integral),
(Derivative)                    ,

                              (Set-
Point)
       PID

.                    (Cruise   Control)
                  (Thermostat)

                 .

(      ) = (      ) – (      )

                 . PID

                                    .

PID

    .                              .

P Proportional Ban = 100/gain
I        Integral = 1/reset(units of time)
D Derivative = rate = pre-act(units of time)

              integral        reset action
time/repeat        repeat/time              .

          time/repeat          reset
            repeat/time            integral
     . Derivative    rate            .

**Proportional Band**

              Proportional

                 .

(                ) = (     ) * 100/(Propotional
band)
Proportional controller     offset(set- poin
     )                              gain
       loop                    .
     Integral  action      offset
                 .

**Integral**

Integral

                         . Integral
offset                .

CONTROLLER OUTPUT
= (1/INTEGRAL) (Integral of) e(t) d(t)

       1
offset (                )
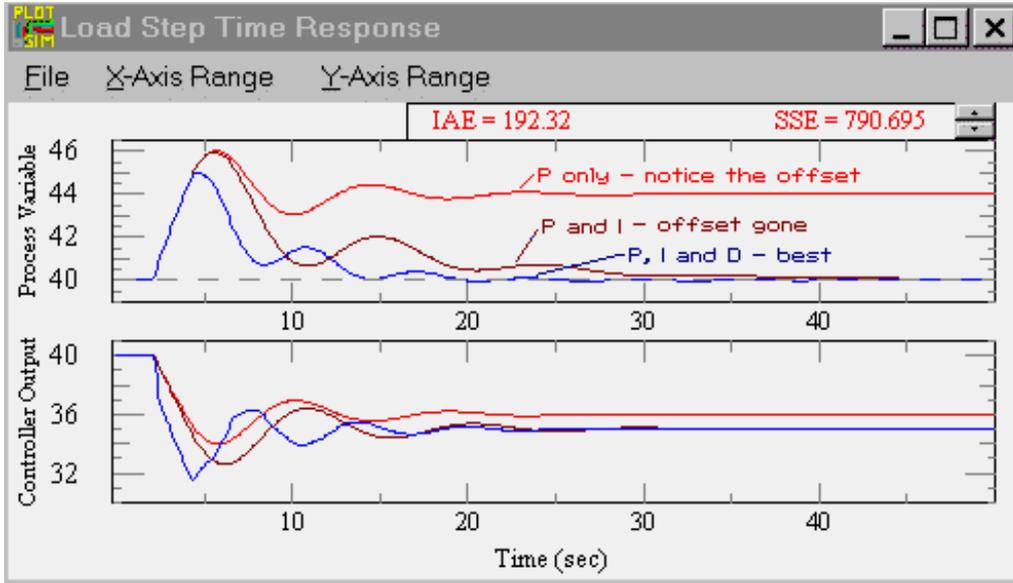              .

derivative                        .
(Graphic   courtesy   of   ExperTune   Loop
Simulator)

**Derivative**

Derivative

                              .

     .
CONTROLLER OUTPUT =

$$\text{DERIVATIVE} \quad \frac{dm}{dt}$$

1

m          t                    .                              ratio                                                    .
                                                             Integral

                derivative          pre- act    gain          derivative              "dip"
     term rate                                                      .  Derivative
                 .                                        derivative                    .
                                                  (314    radians/time        :
DERIVATIVE = RATE = PRE ACT                 Nyquist   frequency)
                                            amplitude ratio              bit              .
Derivative                                                           sampling          .
    .  Proportional
                                   .  load     amplitude    ratio                 Nyquist
                                   frequency                                  .
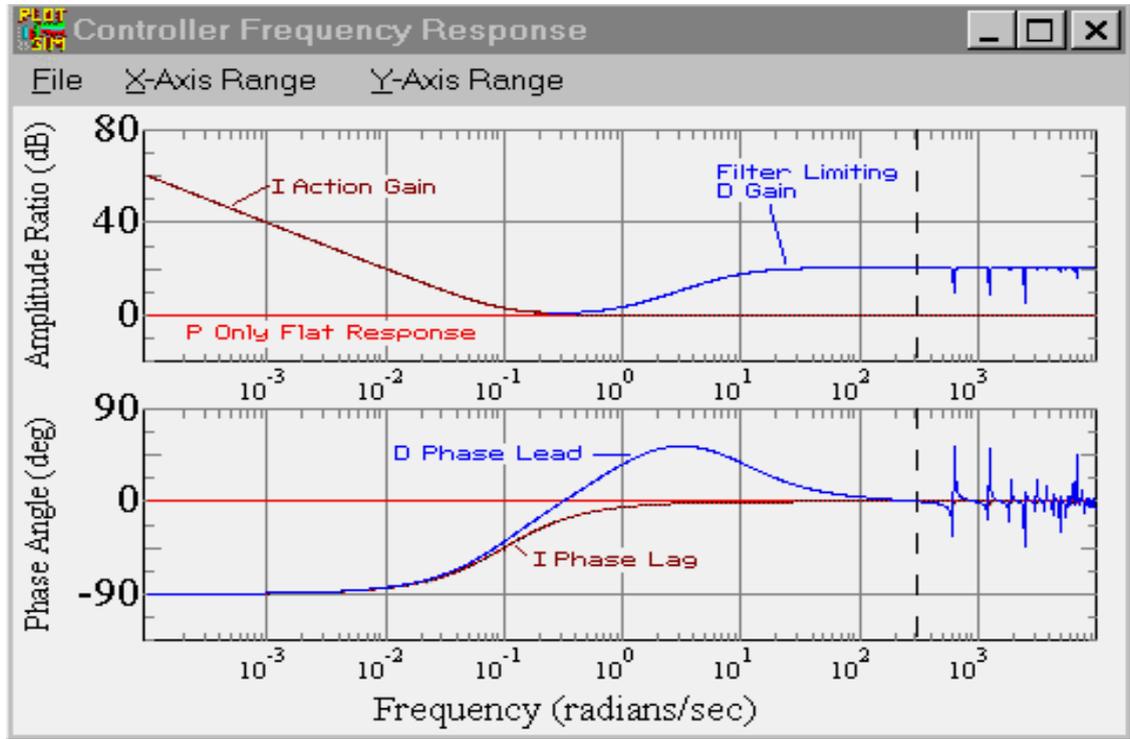derivative                                               PI
                                       .  Derivative          loop
    .  Derivative                                   .
        .

**Control Loop Tuning**

Derivative                lead
loop                            .                              loop

    2         PID              amplitude                    .

2

trim                                                                                    .

                                                            .

                                                5%        10%

                        loop                    loop                                    .

                            .                            P        Proportional    Band                    ,    I
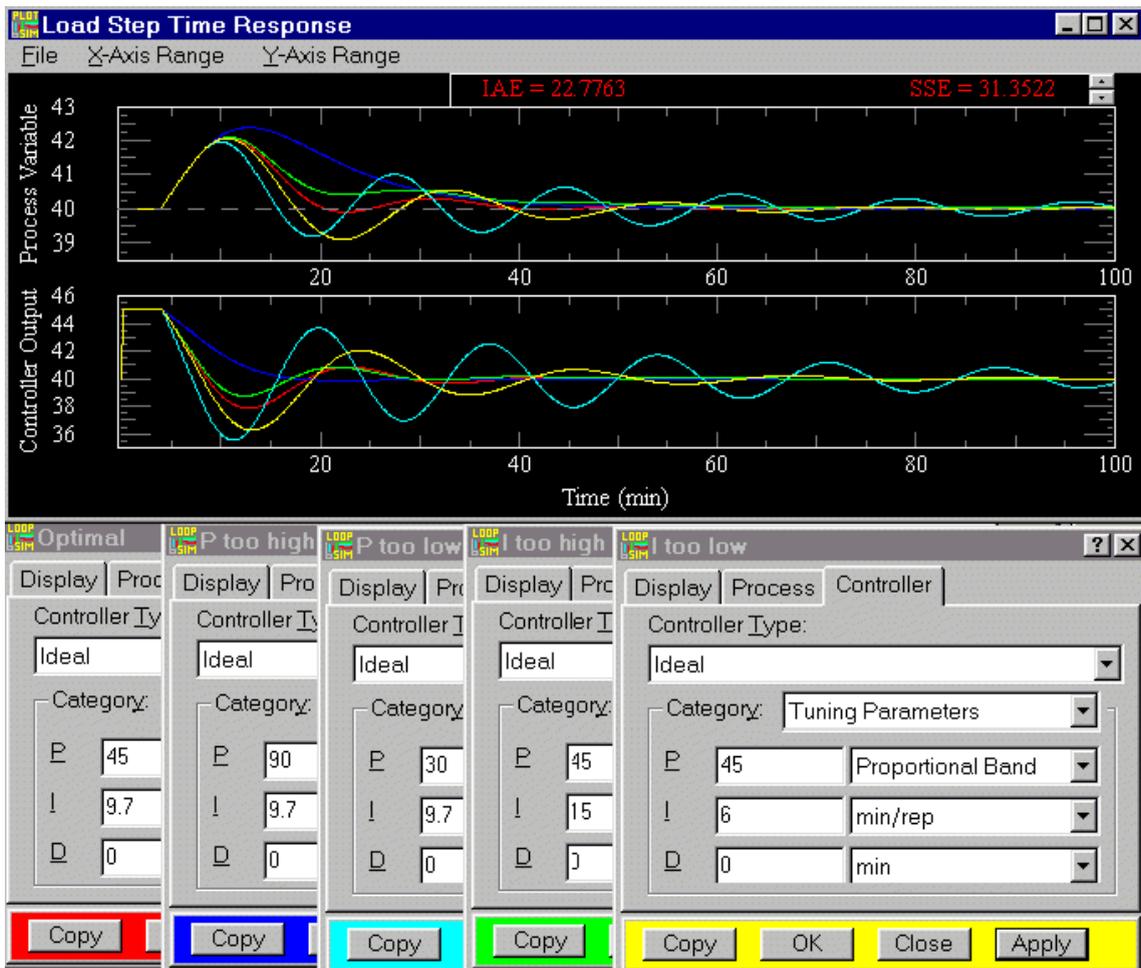                                                            time/repeat                        P        I

**Fine Tuning "Rules"**

                                                            .

Loop Simulator                        3    PI
                                I    P                                                    **PID**
                            .

    dead time 4, lag time 10            .

                                    .(                                                            4
                                    )                    .                    .

                                                                                                        .

                    .        I            P

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| Loop Type | PB % | Integral min/rep | Integral rep/min | Derivative min | Valve type |
|---|---|---|---|---|---|
| Flow | 50 to 500 | .005 to .05 | 20 to 200 | none | Linear or Modified Percentage |
| Liquid Pressure | 50 to 500 | .005 to .05 | 20 to 200 | none | Linear or Modified Percentage |
| Gas Pressure | 1 to 50 | .1 to 50 | .02 to 10 | .02 to .1 | Linear |
| Liquid Level | 1 to 50 | 1 to 100 | .01 to 1 | .01 to .05 | Linear or Modified Percentage |
| Temperature | 2 to100 | .2 to 50 | .02 to 5 | .1 to 20 | Equal Percentage |
| Chromatograph | 100 to 2000 | 10 to 120 | .008 to .1 | .1 to 20 | Linear |

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