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OT30PidReg

O = Digital Output

T = Control functions

The OT30PidReg function implements a generic PID regulator. In addition to providing the regulation value, the function allows to suspend the regulator's update while maintaining the values of the various control registers and the same control output. In addition, you can adjust the control so that the control output is handled in inverse proportion to the error.

IMPLEMENTATION

OT30PidReg (aswParReg , aswParUsr, gwSetPoint, gwMeasure, aglOutReg)

Parameters:

IN/OUT	VARIABLE TYPE	EXAMPLE NAME	DIM	
IN	ARRSYS	aswParReg [1]	W	Sample time PID regulator (sec/100) [0÷32767].
IN	ARRSYS	aswParReg [2]	W	Maximum scale limit of regulation variable (UM) [-32768÷32767]
IN	ARRSYS	aswParReg [3]	W	Minimum scale limit of regulation variable (UM) [-32768÷32767]
IN	ARRSYS	aswParReg [4]	W	Maximum value of regulation output [-32768 ÷32767]
IN	ARRSYS	aswParReg [5]	W	Minimum value of regulation output [-32768 ÷32767]
IN	ARRSYS	aswParReg [6]	W	Positive saturation value regulation output [-32768 ÷32767]
IN	ARRSYS	aswParReg [7]	W	Negative saturation value regulation output [-32768 ÷32767]
IN	ARRSYS	aswParReg [8]	W	Setting flags: bit 0: <i>EnableReg</i> . Enables regulator; with disabled regulator everything is 0. bit 1: <i>FreezeReg</i> . Freeze updating the controller. bit 2: <i>InvertOut</i> . Reverses the regulator output bit 3: <i>DisIntTm</i> Disable the internal timer, This function should be called every sampling time.
IN	ARRSYS	aswParUsr [1]	W	Proportional gain.(%) [0÷9999]
IN	ARRSYS	aswParUsr [2]	W	Integral time (sec/100) [0÷9999]
IN	ARRSYS	aswParUsr [3]	W	Derivative time (sec/100) [0÷9999]
IN	ARRSYS	aswParUsr [4]	W	Sample time of the derivative [0÷255] 0=sample time PID regulator 1=2*sample time PID regulator n=(n+1)*sample time PID regulator
IN	ARRSYS	aswParUsr [5]	W	Derived filter time constant (sec/100) [0÷9999]
IN	ARRSYS	aswParUsr [6]	W	Feed Forward (%) [0÷2000]
IN	GLOBAL	gwSetPoint	W	Setpoint of regulation (UM)
IN	GLOBAL	gwMeasure	W	Value of the process variable(UM)
OUT	ARRGBL	aglOutReg[1]	L	PID output log
OUT	ARRGBL	aglOutReg[2]	L	Proportional output log
OUT	ARRGBL	aglOutReg[3]	L	Integral output log
OUT	ARRGBL	aglOutReg[4]	L	Derivative output log
OUT	ARRGBL	aglOutReg[5]	L	Feedforward output log
OUT	ARRGBL	aglOutReg[6]	L	Error log
OUT	ARRGBL	aglOutReg[7]	L	Regulator states: bit 2 = positive saturation state bit 3 = negative saturation state bit 4 = executing state regulation
OUT	ARRGBL	aglOutReg[8]	L	Error code

Errors

After calling the function, the "Error code" variable in aglOutReg[8] takes certain values, the meaning of these values is summarized below:

- 0: No error
- 1: Error setting sampling time
- 2: Error setting lower limit and/or greater of scale
- 3: Error setting value proportional gain
- 4: Error setting integration time
- 5: Error setting derivative time
- 6: Error setting value percentage feed-forward
- 7: Error setting minimum and/or maximum value regulator output
- 8: Error setting sampling time derivative

- 9: Error setting derived filter time constant
- 10: positive saturation value setting exceeds maximum output regulator
- 11: negative saturation value setting exceeds maximum output regulator

Example

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Example
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aswParReg [1]=500           ; sample time = 500ms
aswParReg [2]=10000        ; full scale top = 10000
aswParReg [3]=0            ; full scale less = 0
aswParReg [4]=5000         ; Maximum output regulator value
aswParReg [5]=0            ; Minimum output regulator value
aswParReg [6]=2000         ; Positive saturation value regulator output
aswParReg [7]=0            ; Negative saturation value regulator output

aswParUsr[1] = 100         ; Proportional gain = 0.1
aswParUsr[2] = 200         ; Integral time = 2 sec.

aswParReg [8]= aswParReg [8] ORB 1 ; Enable regulation

MAIN:
  gwSetPoint = 800
  OT30PidReg ( aswParReg , aswParUsr, gwSetPoint, gwMeasure, aslOutReg )
  WAIT 1
  JUMP MAIN

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Definition of regulator

A regulator reads an input variable (gwMeasure), compares it to a reference signal (gwSetPoint) and change the value of the output (aslOutReg[7]) to achieve equality of the variable with the reference.

PID regulator

One of the most popular types of regulators is the PID (Proportional, Integral, Derivative).

Proportional action

This control action establishes a relationship of direct proportionality between the error (aglOutReg[6]) and the controller output value. The proportional gain parameter (aswParUsr [1]) defines the extent of proportional action; it's expressed in thousandths, then to set gain of 0.5 you should enter the value 500.

The rule establishing the output value (aslOutReg[7]) defines: with unity gain (1000), the control output will be maximum when the error is equal to the difference between "Maximum scale limit" and "Maximum scale limit" that is the result between aswParReg [2] - aswParReg [3].

Integral action

The integral action of the PID regulator calculates the integral of the error on a user-settable time interval through the aswParUsr [2] parameter (expressed in hundredths of a second). The output signal is updated in a particular way: whenever the Integrator gives an output value that is added to the value that is on the register, then it will continue to increase or decrease (depending on the sign of the error). The output value is calculated as follows: with unit proportional gain, the integration time (aswParUsr [2]) is the necessary time that the integral log (aglOutReg[3]) reaches the proportional registry value (aglOutReg[2]). From this last statement shows that the integral action is related to the proportional action.

Derivative action

The derivative action try to in a sense of "anticipating" the behavior of the system being monitored. The output produced is proportional to the change of the input signal. The amount of the derivative effect is adjustable via the time derivative (aswParUsr [3]) parameter. The derivative action computing is based on the following convention: the derivative time is the time necessary for, with constant error variation, the derivative log (aglOutReg[4]) reaches a value equal to the proportional log (aglOutReg[2]). As for the integral action shows that even for the derivative action is there a link with the proportional controller. More higher is the derivative time of the error, more faster is the system in the transient error recovery. The derivative action may never be used alone because in the presence of constant mistakes its effect would be null.

Feed-forward action

In addition to the PID controller is also present the feed-forward action: it generates an output proportional to the setpoint value (as can be inferred from the name doesn't exploit any error feedback). Its function is to reduce the system response time providing an output already close to what the regulator should reach. The contribution of this action is adjustable via the feed forward parameter (aswParUsr [6]): This parameter is expressed as a portion to 0.001 mm (to introduce for example, 98.5% is

necessary to set the value 985).

Setting a value of 100%, when the setpoint (gwSetPoint) will be equal to "Maximum scale limit" (aswParReg [2]) the feed-forward output value will be equal to "maximum value of regulation output" (aswParReg [4]); when the setpoint setpoint (gwSetPoint) will be equal to "Minimum scale limit" (aswParReg [3]) the feed-forward output value will be equal to "minimum value of regulation output" (aswParReg [5]);

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