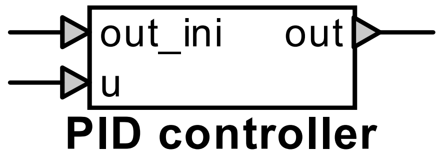
Control function: PID controller, fixed coefficients



1 Description

This device is an implementation of a PID (proportional-integral-differential) controller with fixed coefficients. For a version with variable coefficients, use the device "PID controller, dynamic".

1.1 Pins

This device has three pins:

pin	*type*	*description*
out_ini	input	initial value of output at t=0
u	input	controller input
out	output	controller output

1.2 Parameters

The following parameters must be defined:

parameter	*description*
Kp	gain of proportional signal
Ki	gain of integral signal
Kd	gain of differential signal
stepped	=1 to indicate stepped transitions =0 to indicate ramped transitions

The value of the parameter *stepped* determines whether the device operates with *stepped* or *ramped* transitions. In *stepped* mode (the default for ideal logical signals), the output is represented as a stepped signal, where changes in value are observed as vertical steps at the time they occur. In *ramped* mode, the value transitions of the output are seen as ramps between $t\text{-}\Delta t$ and t.

1.3 Input

The input pins may be connected to any control signals.

1.4 Output

The output is a weighted sum of the input signal (proportional part), of the time integral of the input signal (integral part), and of the time derivative of the input signal (differential part).

The representation of the output as having *stepped* or *ramped* transitions is determined by the value given to the parameter *stepped*.

1.5 Representation

The implementation of the model can be inspected by opening the device's subcircuit.

The model applies the following equation:

$$\text{out} = K_p \cdot u + K_i \cdot \int u \cdot dt + K_d \cdot \frac{du}{dt} \qquad (1)$$

The model is self-initializing at t=0. The initial value of the derivative is considered to be zero (input signal considered as constant for $t \leq 0$). The initial value of the integral is calculated as the value producing the given initial value of the output at t=0:

$$\text{initial value of integral} = (\text{out\_ini} - K_p \cdot u(0)) / K_i \qquad (2)$$

producing

$$\text{out}(0) = K_p \cdot u(0) + K_i \cdot (\text{initial value of integral}) + K_d \cdot 0 \qquad (3)$$