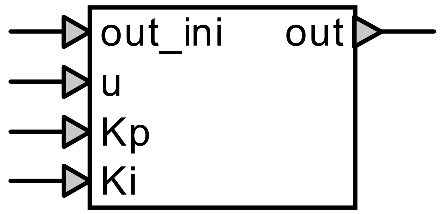
Control function: PI controller, dynamic coefficients



PI controller

1 Description

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

1.1 Pins

This device has five pins:

pin	*type*	*description*
out_ini	input	initial value of output at t=0
u	input	controller input
Kp	input	gain of proportional signal
Ki	input	gain of integral signal
out	output	controller output

1.2 Parameters

The following parameter must be defined:

parameter	*description*
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) and of the time integral of the input signal (integral 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:

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

The model is self-initializing at t=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

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