_10-proportional-integral-derivative

goal: techniques for analysis, design, & implementation of the most ubiquitous control architecture

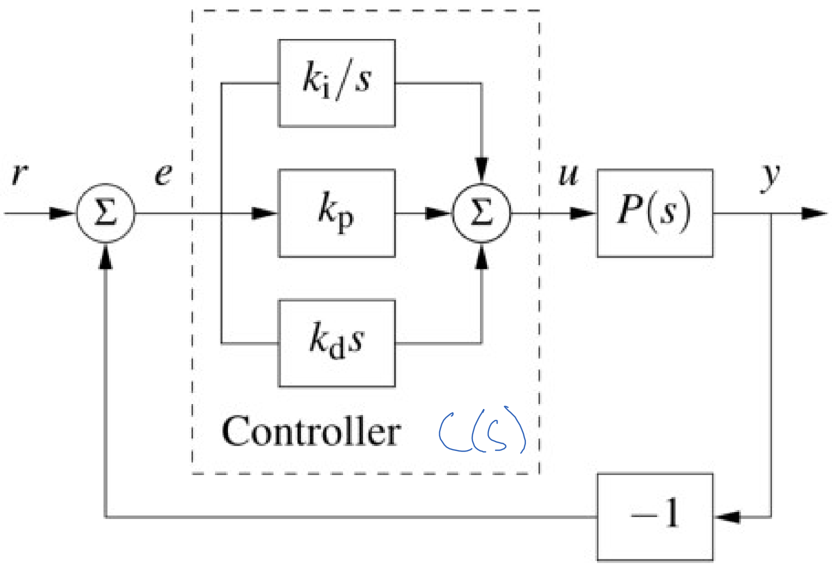
Based on a survey of over eleven thousand controllers in the refining, chemicals and pulp and paper industries, 97% of regulatory controllers utilize a PID feedback control algorithm.

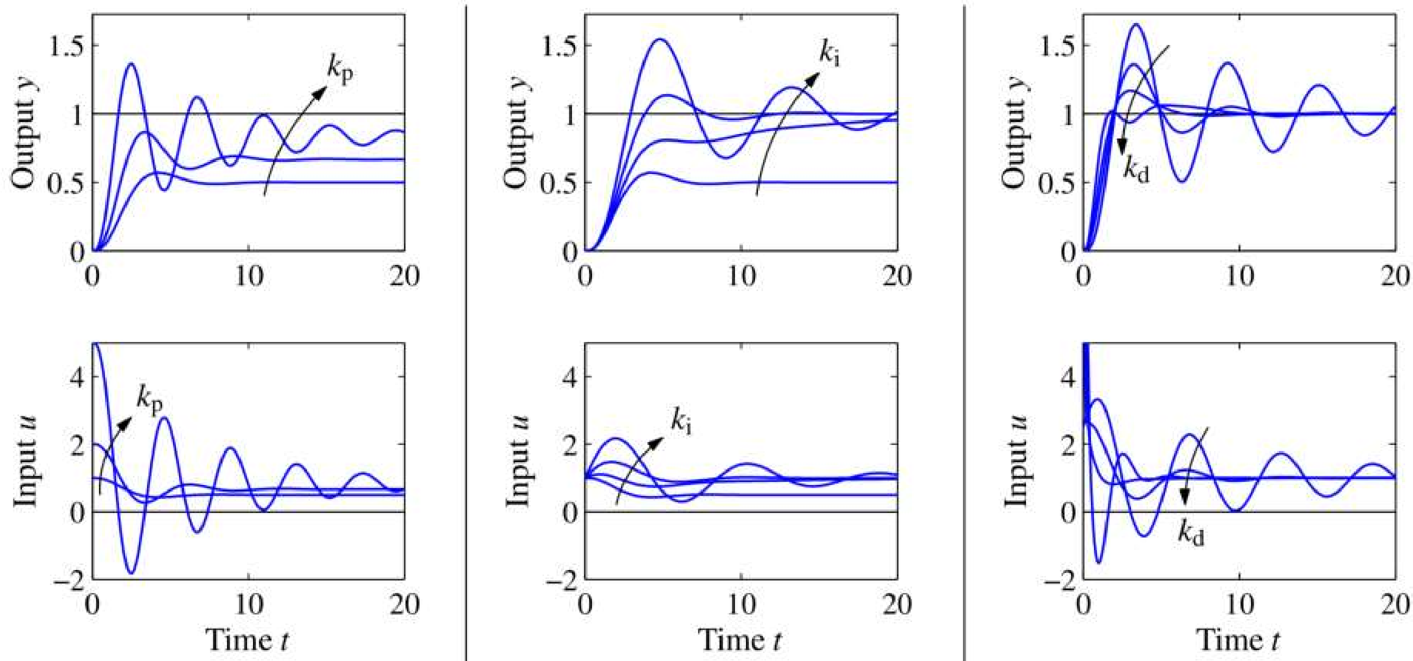
L. Desborough and R. Miller, 2002 [DM02a].

1°. essentials of feedback control [AMv2 Ch 11]
  1¹. a simple controller [Nv7 Ch 9.4]
  1². implementation issues

1°. essentials of feedback control

1': a simple controller

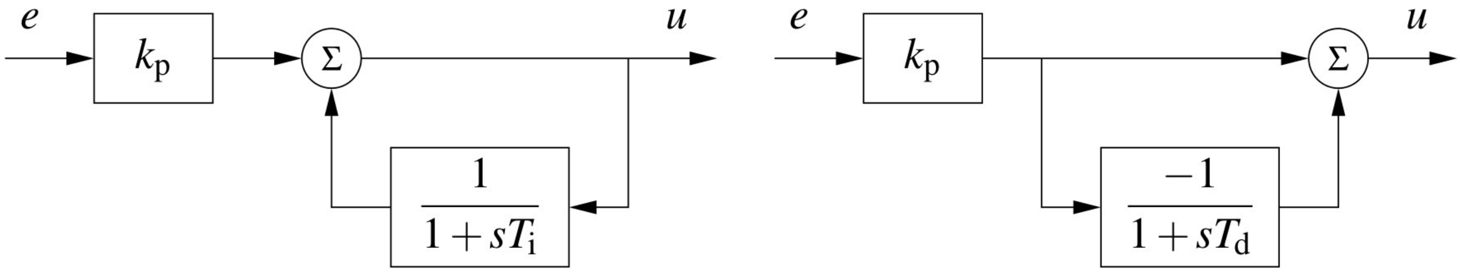




(a) Proportional control (b) PI control (c) PID control

Figure 11.2: Responses to step changes in the reference value for a system with a proportional controller (a), PI controller (b) and PID controller (c). The process has the transfer function $P(s) = 1/(s+1)^3$, the proportional controller has parameters $k_p = 1$, 2 and 5, the PI controller has parameters $k_p = 1$, $k_i = 0$, 0.2, 0.5, and 1, and the PID controller has parameters $k_p = 2.5$, $k_i = 1.5$ and $k_d = 0$, 1, 2, and 4.

1^2. implementation issues



(a) Integral action (automatic reset) (b) Derivative action

Figure 11.3: Implementation of integral and derivative action. The block diagram in (a) shows how integral action is implemented using *positive feedback* with a first-order system, sometimes called automatic reset. The block diagram in (b) shows how derivative action can be implemented by taking differences between a static system and a first-order system.

Type	k_p	T_i	T_d
P	$0.5k_c$		
PI	$0.4k_c$	$0.8T_c$	
PID	$0.6k_c$	$0.5T_c$	$0.125T_c$