PID Control

Proportional-Integral-Derivative

PID control

One simple and commonly used type of feedback controller is the **proportional-integral-derivative (PID) controller**:

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau)\mathrm{d}\tau + K_d \frac{\mathrm{d}e}{\mathrm{d}t}$$

This consists of:

- A **proportional term** to account for present errors.
- An **integral term** to account for past errors.
- A **derivative term** to account for future errors.
- A **gain** parameter for each term to calibrate the behavior.

Discrete time PID

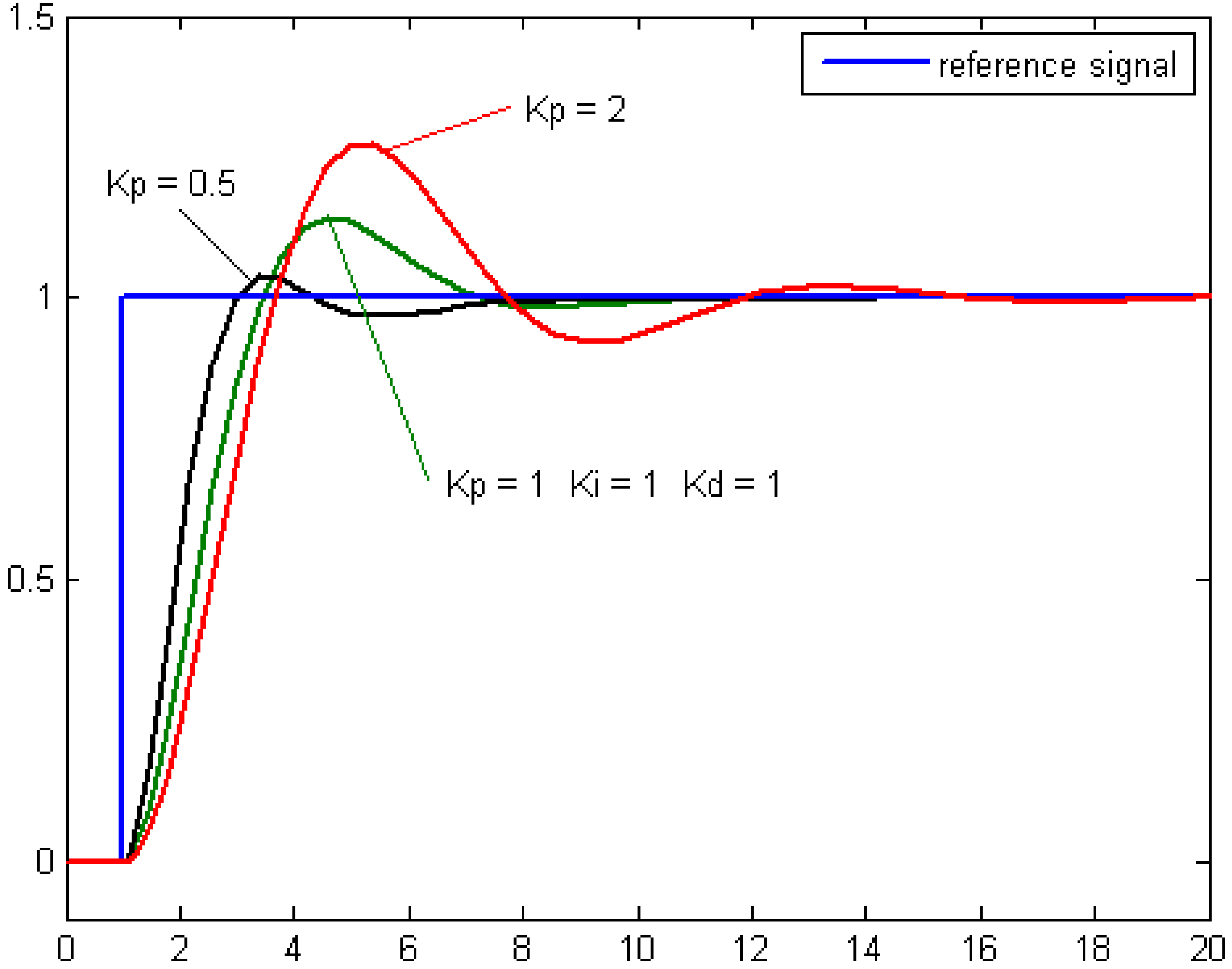
A **discrete-time system** is one in which we can only measure the state at fixed intervals.

In that case, we can use discrete approximations:

$$u_k = K_p e_k + K_i \left(\Delta t \sum_{i=1}^{k} e_i \right) + K_d \left(\frac{e_k - e_{k-1}}{\Delta t} \right)$$

PID Tuning

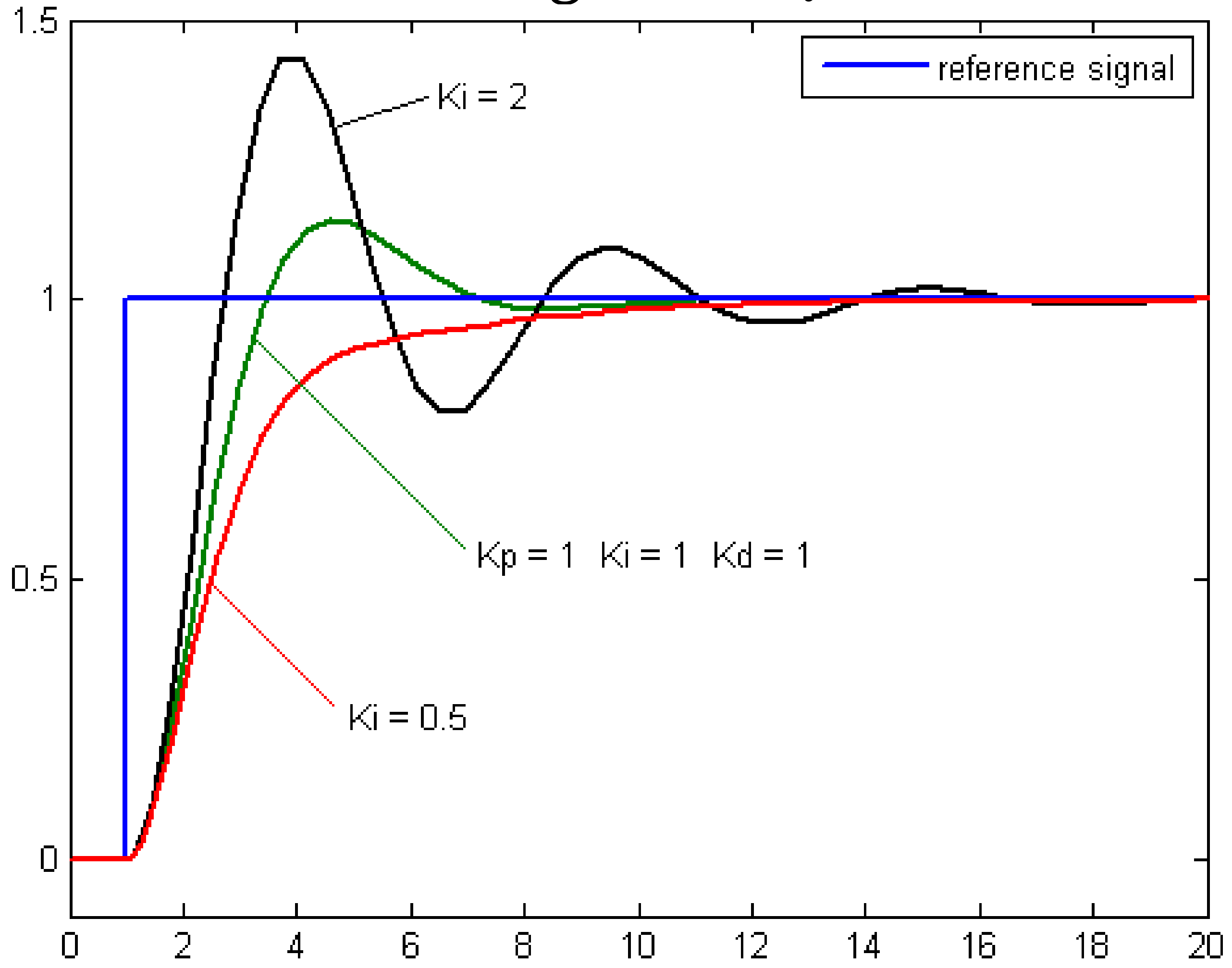
Changes to K_p:



[en.wikipedia.org]

PID Tuning

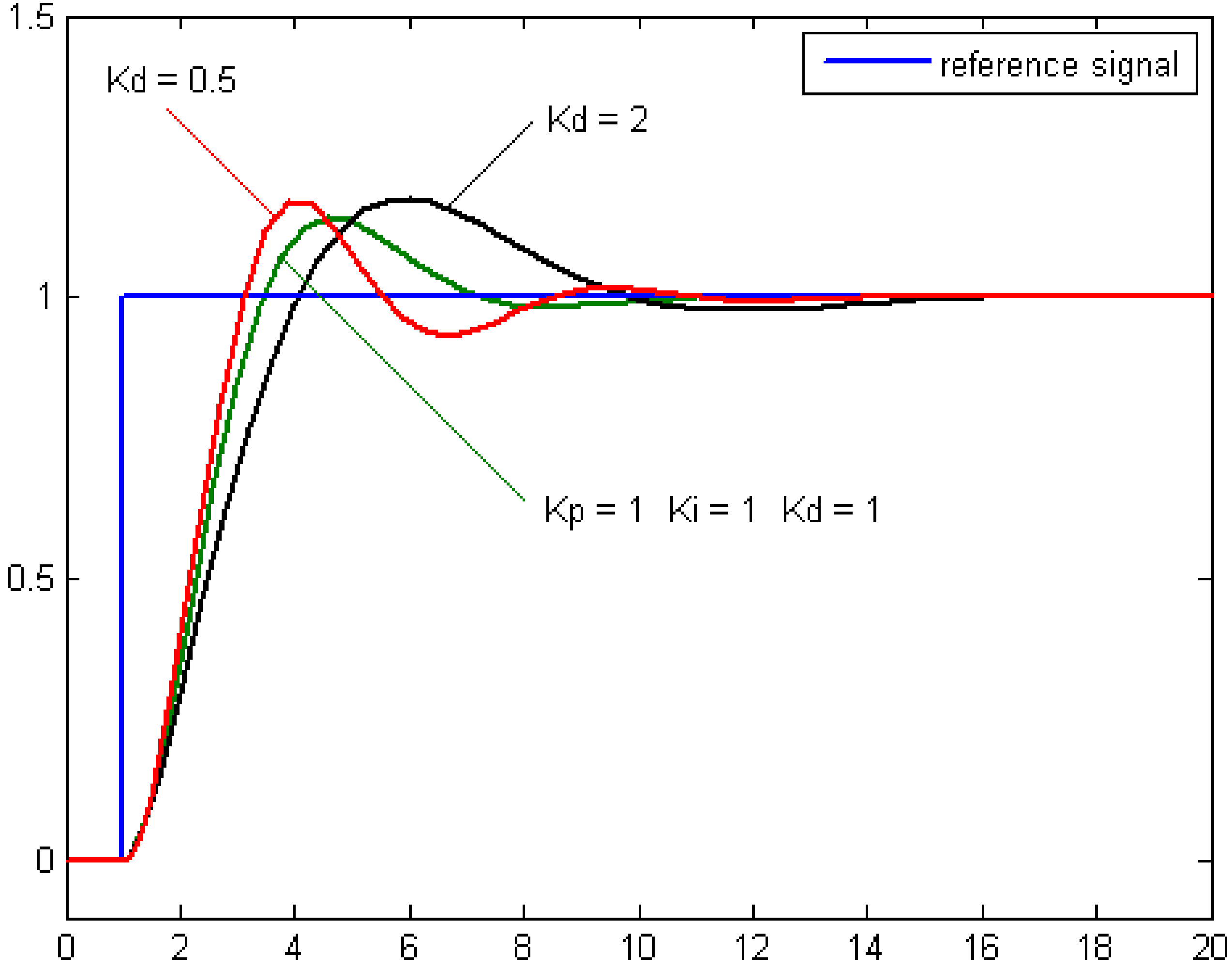
Changes to K_i:



[en.wikipedia.org]

PID Tuning

Changes to K_d:



[en.wikipedia.org]