Consider a first order continuous time linear system with dynamics given by:

$$\dot{x} = -x + u \tag{1}$$

In discrete time, a "zero-order-hold" holds the value of the control input $u(t)$ constant for one time step T, i.e. the control $u(t) = u(kT)$ for $kT \leq t < kT + T$.

Let the error $e(t) = r(t) - x(t)$, and a feedback controller is chosen such that $u(t) = 3(x(t) - r(t))$ where $r(t)$ is the reference. Here $r(t)$ is the unit step.

Assume the system has initial condition $x(0) = 0$. The state and error are listed in the table below at each T. Note that the system is continuous, but the control value is held constant and updated at each T.

t (sec)	x(t)	e(t) = r(t) - x(t)	u(t)
0^-	0	0	0
0	0	1	3
1	2	-1	-3
2	-1	2	6
3	3.5	-2.5	-7.5
4	-3.5	4.5	13.5
5	6.5	-5.5	-16.5

This example is unstable. By reducing the sampling period, (even while keeping the gain the same), the control system can be made stable.