ver comentario (sticky note)

Table 2.1 Zero-order hold sampling of a continuous-time system, $G(s)$. The table gives the zero-order-hold equivalent of the continuous-time system, $G(s)$, preceded by a zero-order hold. The sampled system is described by its pulse-transfer operator. The pulse-transfer operator is given in terms of the coefficients of

$$H(q) = \frac{b_1 q^{n-1} + b_2 q^{n-2} + \cdots + b_n}{q^n + a_1 q^{n-1} + \cdots + a_n}$$

$G(s)$	$H(q)$ or the coefficients in $H(q)$
$\frac{1}{s}$	$\frac{h}{q-1}$
$\frac{1}{s^2}$	$\frac{h^2(q+1)}{2(q-1)^2}$
$\frac{1}{s^m}$	$\frac{q-1}{q} \lim_{a\to 0} \frac{(-1)^m}{m!} \frac{\partial^m}{\partial a^m} \left(\frac{q}{q-e^{-ah}} \right)$
e^{-sh}	q^{-1}
$\frac{a}{s+a}$	$\frac{1-\exp(-ah)}{q-\exp(-ah)}$
$\frac{a}{s(s+a)}$	$b_1 = \frac{1}{a}(ah - 1 + e^{-ah})$ $\quad b_2 = \frac{1}{a}(1 - e^{-ah} - ahe^{-ah})$ $a_1 = -(1 + e^{-ah})$ $\quad a_2 = e^{-ah}$
$\frac{a^2}{(s+a)^2}$	$b_1 = 1 - e^{-ah}(1 + ah)$ $\quad b_2 = e^{-ah}(e^{-ah} + ah - 1)$ $a_1 = -2e^{-ah}$ $\quad a_2 = e^{-2ah}$
$\frac{s}{(s+a)^2}$	$\frac{(q-1)he^{-ah}}{(q-e^{-ah})^2}$
$\frac{ab}{(s+a)(s+b)}$ $a \neq b$	$b_1 = \frac{b(1-e^{-ah}) - a(1-e^{-bh})}{b-a}$ $b_2 = \frac{a(1-e^{-bh})e^{-ah} - b(1-e^{-ah})e^{-bh}}{b-a}$ $a_1 = -(e^{-ah} + e^{-bh})$ $a_2 = e^{-(a+b)h}$

Table 2.1 *continued*

$G(s)$	$H(q)$ or the coefficients in $H(q)$
$\dfrac{(s+c)}{(s+a)(s+b)}$ $a \neq b$	$b_1 = \dfrac{e^{-bh} - e^{-ah} + (1-e^{-bh})c/b - (1-e^{-ah})c/a}{a-b}$ $b_2 = \dfrac{c}{ab} e^{-(a+b)h} + \dfrac{b-c}{b(a-b)} e^{-ah} + \dfrac{c-a}{a(a-b)} e^{-bh}$ $a_1 = -e^{-ah} - e^{-bh} \qquad a_2 = e^{-(a+b)h}$
$\dfrac{\omega_0^2}{s^2 + 2\zeta\omega_0 s + \omega_0^2}$	$b_1 = 1 - \alpha\left(\beta + \dfrac{\zeta\omega_0}{\omega}\gamma\right) \qquad \omega = \omega_0\sqrt{1-\zeta^2} \qquad \zeta < 1$ $b_2 = \alpha^2 + \alpha\left(\dfrac{\zeta\omega_0}{\omega}\gamma - \beta\right) \qquad \alpha = e^{-\zeta\omega_0 h}$ $a_1 = -2\alpha\beta \qquad \beta = \cos(\omega h)$ $a_2 = \alpha^2 \qquad \gamma = \sin(\omega h)$
$\dfrac{s}{s^2 + 2\zeta\omega_0 s + \omega_0^2}$	$b_1 = \dfrac{1}{\omega} e^{-\zeta\omega_0 h}\sin(\omega h) \qquad b_2 = -b_1$ $a_1 = -2e^{-\zeta\omega_0 h}\cos(\omega h) \qquad a_2 = e^{-2\zeta\omega_0 h}$ $\omega = \omega_0\sqrt{1-\zeta^2}$
$\dfrac{a^2}{s^2 + a^2}$	$b_1 = 1 - \cos ah \qquad b_2 = 1 - \cos ah$ $a_1 = -2\cos ah \qquad a_2 = 1$
$\dfrac{s}{s^2 + a^2}$	$b_1 = \dfrac{1}{a}\sin ah \qquad b_2 = -\dfrac{1}{a}\sin ah$ $a_1 = -2\cos ah \qquad a_2 = 1$
$\dfrac{a}{s^2(s+a)}$	$b_1 = \dfrac{1-\alpha}{a^2} + h\left(\dfrac{h}{2} - \dfrac{1}{a}\right) \qquad \alpha = e^{-ah}$ $b_2 = (1-\alpha)\left(\dfrac{h^2}{2} - \dfrac{2}{a^2}\right) + \dfrac{h}{a}(1+\alpha)$ $b_3 = -\left[\dfrac{1}{a^2}(\alpha - 1) + \alpha h\left(\dfrac{h}{2} + \dfrac{1}{a}\right)\right]$ $a_1 = -(\alpha+2) \qquad a_2 = 2\alpha + 1 \qquad a_3 = -\alpha$