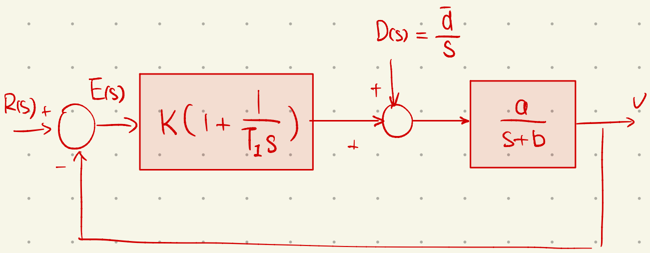
1

Unity feed back

$$G D_{cl}(s) = \frac{a}{s+b}$$

$$\lim_{s\to 0} G D_{cl}(s) = \frac{a}{b} \text{ (finite)} \quad \text{Type 0.}$$



$$E(s) = \left(R(s)\right) - \left(E(s)\, K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b}\right)$$

$$E(s)\left[1 + K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b}\right] = R(s)$$

$$\frac{E(s)}{R(s)} = \frac{1}{1+K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b}} = \frac{s+b}{s+b+K\left(1+\frac{1}{T_I s}\right)a} = \frac{s+b}{s+b+Ka+\frac{Ka}{T_I s}} = \frac{s(s+b)}{s^2+(Ka+b)s+Ka/T_I}$$

$$E(s) = -\left(E(s)K\left(1+\frac{1}{T_I s}\right) + D(s)\right)\frac{a}{s+b}$$

$$E(s) = -E(s)K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b} + \frac{a}{s+b}D(s)$$

$$\left[1+K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b}\right]E(s) = \frac{a}{s+b}D(s)$$

$$\frac{E(s)}{D(s)} = \frac{\frac{a}{s+b}}{\left[1+K\left(1+\frac{1}{T_I s}\right)\frac{a}{s+b}\right]} = \frac{a}{s+b+K\left(1+\frac{1}{T_I s}\right)a} = \frac{a}{s+b+Ka+\frac{Ka}{T_I s}}$$

$$\frac{E(s)}{D(s)} = \frac{as}{s^2+(Ka+b)s+Ka/T_I}$$

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$$E^R(s) = \frac{E(s)}{R(s)} * R(s) = \frac{\cancel{s}(s+b)}{s^2+(Ka+b)s+Ka/T_I} * \frac{\bar{v}}{\cancel{s}} = \frac{\bar{v}(s+b)}{s^2+(Ka+b)s+Ka/T_I}$$

$$E^D(s) = \frac{E(s)}{D(s)} * D(s) = \frac{a\cancel{s}}{s^2+(Ka+b)s+Ka/T_I} * \frac{\bar{d}}{\cancel{s}} = \frac{a\bar{d}}{s^2+(Ka+b)s+Ka/T_I}.$$

$$E^{Accurate}(s) = E^R(s) + E^D(s) = \frac{\bar{v}(s+b)}{s^2+(Ka+b)s+Ka/T_I} + \frac{a\bar{d}}{s^2+(Ka+b)s+Ka/T_I}.$$

③ $\lim_{s \to 0} s E^{\text{Accurate}}(s) = \lim_{s \to 0} s \left(\frac{\bar{v}(s+b)}{s^2 + (ka+b)s + ka/T_I} + \frac{a\bar{d}}{s^2 + (ka+b)s + ka/T_I} \right) = 0$, Exist.