

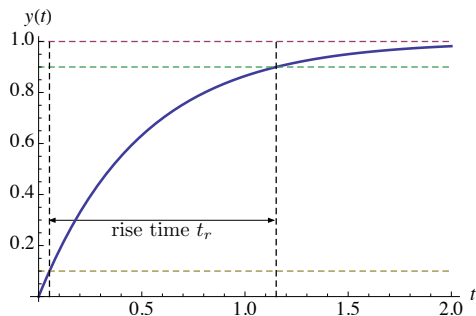
## Transient Response Specifications: Rise Time

Let's first take a look at *1st-order step response*

$$H(s) = \frac{a}{s+a}, \quad a > 0 \quad (\text{stable pole})$$

DC gain = 1 (by FVT)

Step response: 
$$Y(s) = \frac{H(s)}{s} = \frac{a}{s(s+a)} = \frac{1}{s} - \frac{1}{s+a}$$
$$y(t) = \mathcal{L}^{-1}\{Y(s)\} = 1(t) - e^{-at}$$



Rise time  $t_r$ : the time it takes to get from 10% of steady-state value to 90%