Time Response

We still assume no disturbance: $\tau_{\mathrm{e}} = 0$.

So far, we have focused on DC gain only (steady-state response). What about *transient response*?

Open-loop

$$\Omega_{\mathrm{m}} = \frac{AK_{\mathrm{cl}}}{\tau s + 1}\Omega_{\mathrm{ref}}$$

Pole at $s = -\dfrac{1}{\tau}$ $\quad\Longrightarrow\quad$ transient response is $e^{-t/\tau}$

Here, τ is the *time constant*: the time it takes the system response to decay to $1/e$ of its starting value.

In the open-loop case, larger time constant means faster convergence to steady state. This is not affected by the choice of K_{cl} in any way!