Example (continued)

The step response of

$$\ddot{y} + 3\dot{y} + 2y = u, \qquad y(0) = \alpha, \ \dot{y}(0) = \beta$$

is given by

$$y(t) = \frac{1}{2}1(t) + (2\alpha + \beta - 1)e^{-t} + (1/2 - \alpha - \beta)e^{-2t}$$

What are the transient and the steady-state terms?

▶ The transient terms are e^{-t}, e^{-2t} (decay to zero at exponential rates -1 and -2)

  Note the poles of $H(s) = \dfrac{1}{(s+1)(s+2)}$ at $s = -1$ and $s = -2$
  — these are *stable poles* (both lie in LHP)

▶ the steady-state part is $\frac{1}{2}1(t)$ — converges to steady-state value of $1/2$