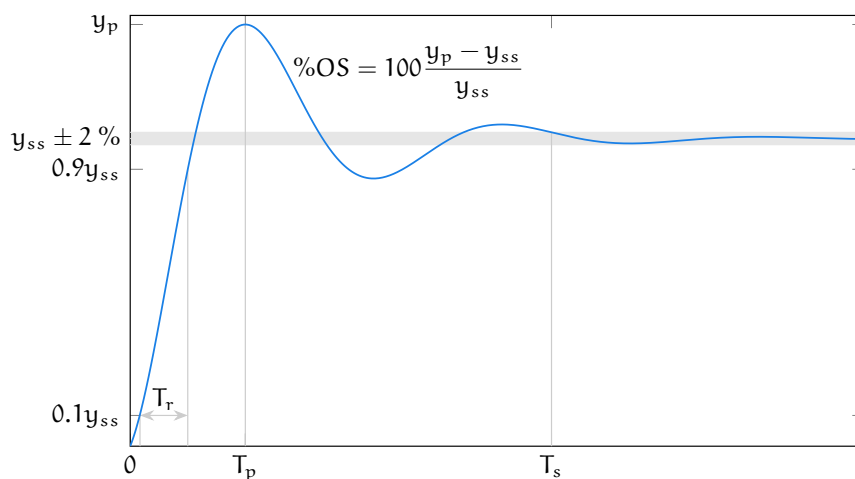


## Lecture 03.06 Transient response characteristics

**step response** We define four transient response characteristics, all defined in terms of a system's *step input response*. For the following, please refer to the illustration in **Figure 03.10**.

- rise time** 1. The *rise time*  $T_r$  is the duration from the time the response reaches 10 % to the time it reaches 90 % of its final value.
- peak time** 2. The *peak time*  $T_p$  is the time at which the response reaches its first or maximum peak.<sup>1</sup>
- percent overshoot** 3. The *percent overshoot* %OS expresses the amount the response overshoots its steady-state value, expressed as a percentage of the steady-state value.
- settling time** 4. The *settling time*  $T_s$  is the time at which the response reaches, and thereafter remains within,  $\pm 2\%$  of its steady-state value.<sup>1</sup>

<sup>1</sup>This definition assumes the step input occurs at  $t = 0$ . Otherwise, subtract the nonzero initial time.



**Figure 03.10:** transient response characteristics rise time  $T_r$ , peak time  $T_p$ , percent overshoot %OS, and settling time  $T_s$  in terms of a response's steady-state  $y_{ss}$  and peak  $y_p$ .