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<u>Examples of systems modeled by 2nd-order ODE with constant</u>
<u>   coefficients</u>
Many physics and engineering problems may be modeled
by 2nd-order ODEs with constant coefficients.

The following systems are completely different processes in
different fields:

All yields the same 2nd-order ODE with constant coefficients.
⇒ Just by learning one ODE, we can interpret the results
in terms of

Depending on the operation conditions, responses can be categorized
as :

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Let's take the spring-mass system for example:

Case I : unforced, undamped

$\boxed{\text{DE}}$ $\qquad my'' + Ky = 0$

$\boxed{\text{roots/solution}}$

$\boxed{\begin{array}{l}\text{behavior/} \\ \text{physical meaning}\end{array}}$

Case II : unforced, damped

$\boxed{\text{DE}}$ $\qquad my'' + by' + Ky = 0$

$\boxed{\text{roots/solution}}$

$\boxed{\begin{array}{l}\text{behavior/} \\ \text{physical meaning}\end{array}}$

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Case Ⅳ : forced, damped

Of particular interest is the response of the system when driven by a

DE

roots/solution

behavior/
physical meaning

— Initially, the response is
— As t increases,
  So we call " y_h " is the
            " y_p " is the
— The system eventually

Case IV : forced, undamped

DE

roots/solution

behavior/
physical meaning

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Example 1: Consider a harmonic oscillator modeled by $y'' + 2y' + 2y = \sin t$. Discuss the system behavior.

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Example 2 : Consider a harmonic oscillator modeled by $y'' + 2y = \cos \omega t$. Discuss the system behavior.