Problem 2

In each of Problems 1 through 4, transform the given equation into a system of first order equations.

\[ u'' + 0.5u' + 2u = 3 \sin t \]

Solution

Let \( u = x_1 \).

\[ x_1'' + 0.5x_1' + 2x_1 = 3 \sin t \]

Finally, let \( x_2 = x_1' \).

\[ x_2' + 0.5x_2 + 2x_1 = 3 \sin t \]

By making these substitutions, the original second-order ODE has become a system of first-order ODEs.

\[
\begin{cases}
  x_1' = x_2 \\
  x_2' = -2x_1 - 0.5x_2 + 3 \sin t
\end{cases}
\]