

# Non-Homogeneous Systems

Now that we can solve linear, constant-coefficient homogeneous systems, we want to look into non-homogeneous systems. How do these systems work?

$$\vec{x}' = A\vec{x} + \vec{f}(t)$$

• Theory/Idea is the same as from non-homogeneous equations.

Thm If  $\vec{x}_1$  and  $\vec{x}_2$  solve the non-homogeneous problem, then  $\vec{x}_1 - \vec{x}_2$  solves the corresponding homogeneous problem.

Idea

General sol to Homog.

General Solution  $\vec{x}_c + \vec{x}_p$

any 1 solution to non-homog.

Therefore, we can come up with method for solving these problems.

1. Find the general solution to the homogeneous problem.
2. Come up with / Find something that solves the non-homogeneous problem.
3. Combine these to get the general solution for the non-homogeneous problem.
4. Pick constants for initial conditions.

## Methods of Solving

There are several different ways we can go about trying to find this particular solution.

1. Undetermined Coefficients.  
→ Guess based on the form of the problem.
2. Variation of parameters.  
→ More complicated method that works all the time.
3. Diagonalization  
→ Solve a set of separate equations instead.