Math 2352–Spring 2016

Worksheet 4: Inhomogeneous odes

To receive credit, hand in as many solved practice problems as time permits. Try unfinished problems at home. Solution of this worksheet will be made available on the website.

1. **(Demonstration)** Explain how to find a particular solution when the inhomogeneous term is an exponential function, a sine or cosine function, or a polynomial. Explain what to do when the inhomogeneous solution is a solution of the homogeneous equation. Here are some examples:

$$\ddot{x} + \dot{x} + x = 6e^{-2t},$$
$$\ddot{x} + \dot{x} + x = \sin 2t,$$
$$\ddot{x} + \dot{x} + x = t^2,$$
$$\ddot{x} + 2\dot{x} + x = e^{-t}.$$

2. **(Demonstration)** Model the three-step solution of an inhomogeneous ode initial value problem:

$$\ddot{x} + 4\dot{x} + 3x = e^{-2t}, \quad x(0) = 1,\ \dot{x}(0) = 0.$$

3. **(Practice)** Find particular solutions:
   (a) $\ddot{x} + 3\dot{x} + 2x = e^{2t}$
   (b) $\ddot{x} + 3\dot{x} + 2x = e^{-2t}$
   (c) $\ddot{x} + 3\dot{x} + 2x = \sin 2t$
   (d) $\ddot{x} + 3\dot{x} + 2x = \cos 2t$
   (e) $\ddot{x} + 3\dot{x} + 2x = 2t$
   (f) $\ddot{x} + 3\dot{x} + 2x = t^2 + 2t$
   (g) $\ddot{x} - x = \cosh t$

4. **(Practice)** Solve the initial value problem:

$$\ddot{x} + 3\dot{x} + 2x = e^{-2t}, \quad x(0) = 0,\ \dot{x}(0) = 0.$$