

Differential Equations I

for Students of Engineering Sciences

Sheet 5, Exercise class

Exercise 1: Determine the solution of the initial value problem

$$y'''(t) + 4y''(t) + 4y'(t) = 8t + 4, \quad y(0) = 0, y'(0) = -1, y''(0) = -2.$$

Exercise 2:

Consider the differential equation

$$y''(t) + 9y(t) = h(t)$$

- a) Determine the real general solution of the corresponding homogeneous differential equation.
- b) Compute the solution of the differential equation with inhomogeneity terms
 - i) $h(t) = 5e^{-t}$, ii) $h(t) = 5 \sin(2t)$, iii) $h(t) = 5 \sin(3t)$.
- c) Determine the solution of the corresponding initial value problems for the initial values

$$y(0) = y'(0) = 0.$$

In each case check whether the solutions are bounded for $t \geq 0$ and whenever possible provide upper bounds for $|y(t)|$, $t \geq 0$.

- d) Use the results of part c) to obtain a solution for

$$h(t) = 2e^{-t} + 4 \sin(2t) \text{ and } y(0) = y'(0) = 0.$$

Dates of classes: 12.12.-16.12.2022