

Homework assignment 3*

Due date: December 4, 2006.

1. Find the matrix exponentials of the following matrices (Don't use software for your calculations!):

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & -1 & -1 \\ -1 & 0 & -1 \\ -1 & -1 & 0 \end{pmatrix}, \\ \begin{pmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}.$$

2. Solve the following IVP:

$$\dot{x} = \begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix} x + \begin{pmatrix} 1 \\ \cos(t) \end{pmatrix}, \quad x(0) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

3. Do problem 12.5 # 17.
4. Show that the following system does not have non-constant periodic solutions in the region D :

$$\begin{aligned} \dot{x} &= 3x + 2y - xy^2 \\ \dot{y} &= x + 4y - 2x^2y, \end{aligned}$$

where $D = \{(x, y) \mid 2x^2 + y^2 < 7\}$.

*MAP 4305; Instructor: Patrick De Leenheer.