

Problems Day 36, T 4/2/2024

Topic 17: Matrix methods for DEs

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Problem 1. Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2+i & 2-i \\ 3 & -4 & -4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 0 \\ 0 & -3+4i & 0 \\ 0 & 0 & -3-4i \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2+i & 2-i \\ 3 & -4 & -4 \end{bmatrix}^{-1}$

Give the general real-valued solution to $\mathbf{x}' = A\mathbf{x}$.

Problem 2. Solve $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$.

Problem 3.

(a) Give the companion system to $x''' + 2x'' + 4x' + 8x = 0$.

(b) What is the order of the companion system?

Problem 4. (Repeated eigenvalues: defective case – never on a quiz)

Let $A = \begin{bmatrix} 3 & 2 \\ 0 & 3 \end{bmatrix}$. Solve $\mathbf{x}' = A\mathbf{x}$.

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ES.1803 Differential Equations

Spring 2024

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