

Problem 10 (Lecture 10): Chapter 10

Consider the 3×3 matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{pmatrix}$. The matrix A is symmetric and its eigenvalues are the numbers $\lambda_1 = 6$, $\lambda_2 = 0$, and $\lambda_3 = -2$. The following statements are correct: $\lambda_1 = 6$, $\lambda_2 = 0$, $\lambda_3 = -2$, $v_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$, $v_2 = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$, and $v_3 = \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$.

(a) Find a general expression for the n th power of A , A^n , and e^{At} .

(b) Computing in \mathbb{R}^3 , solve the system $x'' + Ax = 0$.

For this problem, you should use the other results you derive in 10a. (10b) suggests the following:

$$\begin{aligned}
 A^n &= \frac{1}{6} \begin{pmatrix} 6^n - 0^n - (-2)^n & 2(6^n - 0^n - (-2)^n) & 3(6^n - 0^n - (-2)^n) \\ 2(6^n - 0^n - (-2)^n) & 6^n - 0^n - (-2)^n & 3(6^n - 0^n - (-2)^n) \\ 3(6^n - 0^n - (-2)^n) & 3(6^n - 0^n - (-2)^n) & 6^n - 0^n - (-2)^n \end{pmatrix} \\
 e^{At} &= \frac{1}{6} \begin{pmatrix} 6e^{6t} - e^{-2t} & 2(6e^{6t} - e^{-2t}) & 3(6e^{6t} - e^{-2t}) \\ 2(6e^{6t} - e^{-2t}) & 6e^{6t} - e^{-2t} & 3(6e^{6t} - e^{-2t}) \\ 3(6e^{6t} - e^{-2t}) & 3(6e^{6t} - e^{-2t}) & 6e^{6t} - e^{-2t} \end{pmatrix}
 \end{aligned}$$

(a) $x'' + Ax = 0$ is a system of three second-order ODEs. The general solution is $x(t) = c_1 v_1 e^{i\sqrt{6}t} + c_2 v_1 e^{-i\sqrt{6}t} + c_3 v_2 e^{i\sqrt{6}t} + c_4 v_2 e^{-i\sqrt{6}t} + c_5 v_3 e^{i\sqrt{6}t} + c_6 v_3 e^{-i\sqrt{6}t}$.
 (b) $x'' + Ax = 0$ is a system of three second-order ODEs. The general solution is $x(t) = c_1 v_1 e^{i\sqrt{6}t} + c_2 v_1 e^{-i\sqrt{6}t} + c_3 v_2 e^{i\sqrt{6}t} + c_4 v_2 e^{-i\sqrt{6}t} + c_5 v_3 e^{i\sqrt{6}t} + c_6 v_3 e^{-i\sqrt{6}t}$.

Luenberger Chapter 7 Problem 7

Rachel S Tattersall



Luenberger Chapter 7 Problem 7:

Luenberger Chapter 7 Problem 7 Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Luenberger Chapter 7 Problem 7**," compiled by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we shall delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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