

Assignment-3

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Abstract—In this work, we evaluate the matrix equation, to get the value of 'k'. In addition, we find the characteristic equation for the given matrix.

Hence, (2.0.7) is the required characteristic equation.

Download all python codes from

[https://github.com/poojah15/
EE5609_AI20MTECH14003/tree/
master/Assignment_3](https://github.com/poojah15/EE5609_AI20MTECH14003/tree/master/Assignment_3)

Download all latex-tikz codes from

[https://github.com/poojah15/
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master/Assignment_3/New_version](https://github.com/poojah15/EE5609_AI20MTECH14003/tree/master/Assignment_3/New_version)

1 PROBLEM STATEMENT

If $A = \begin{pmatrix} 3 & -2 \\ 4 & -2 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find k so that $A^2 = kA - 2I$

2 SOLUTION

For a general square matrix A of dimension n x n, the characteristic equation in variable λ is defined by,

$$\det(A - \lambda I) = 0 \quad (2.0.1)$$

where, I is the identity matrix of size n x n. Hence, given $A = \begin{pmatrix} 3 & -2 \\ 4 & -2 \end{pmatrix}$, the characteristic equation is computed as follows:

$$\left| \begin{pmatrix} 3 & -2 \\ 4 & -2 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right| = 0 \quad (2.0.2)$$

$$\Rightarrow \begin{vmatrix} 3-\lambda & -2 \\ 4 & -2-\lambda \end{vmatrix} = 0 \quad (2.0.3)$$

By expanding the above determinant we get,

$$(3 - \lambda)(-2 - \lambda) + 8 = 0 \quad (2.0.4)$$

$$\Rightarrow -6 + \lambda^2 + 2\lambda - 3\lambda + 8 = 0 \quad (2.0.5)$$

$$\Rightarrow \lambda^2 - \lambda + 2 = 0 \quad (2.0.6)$$

$$\Rightarrow \lambda^2 = \lambda - 2 \quad (2.0.7)$$