**ME 5554 / AOE5754 / ECE5754**

**Applied Linear Systems**

**HW1**

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**1. Determine the eigenvalues and corresponding eigenvectors of matrix:**

**\*** Eigenvalue of A is a number λ with:

Determinant of :

Assume that *det(A - λI) = 0*, we have:

So we have 4 results of λ:

**\*** Eigenvector v of A is a 4x1 matrix:

and:

**-** For *λ1 = a + bi*:

so:

⇒

⇒ for any α1 ≠ 0

- For *λ2 = a – bi*:

so:

⇒

⇒ for any α2 ≠ 0

- For *λ3 = c + di*:

so:

⇒

⇒ for any α3 ≠ 0

- For *λ4 = c – di:*

so:

⇒

⇒ for any α4 ≠ 0

**2. Compute the determinant of matrix A:**

**\*** Compute determinant by using the rule of Sarrus:

=

**\*** Compute determinant using the first column:

=

=

**NE1.2 Define the state variables and derive the coefficient matrices**

**a.**

Define:

so:

We have: ⇔

and

So: State matrix A: A = -2

Input matrix B: B = 1

Output matrix: C = 1

Direct Transmission matrix D: D = 0

**b.**

Define:

so:

We have:

⇔

So:

and:

Finally: State matrix A is:

Input matrix B is:

Output matrix C is:

Direct Transmission matrix: D = 0

**c.**

Define:

so:

We have:

⇔

So:

and:

Finally: State matrix A is:

Input matrix B is:

Output matrix C is:

Direct transmission matrix: D = 0

**d.** (1)

(2)

Define:

so:

We have:

⇔

⇔

So:

Finally: State matrix A is:

Input matrix B is:

Output matrix C is:

Direct Transmission matrix D is: D = 0