TKU211104

Vector and Matrix Theory

Teori Vektor dan Matriks

BASIC INFORMATION

Course Credit	2 / 100 minutes per Week
Course Type	Required
Course Classification	Basic Science
Prerequisites	High School Level Mathematics

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1)

Development of Engineering Solution (KP.2)

Engineering Design (KP.3)

Data and Experiments (KP.4)

Learning Outcomes

LO1 Students are able to explain the concept of vectors and matrices as well as matrices operation, able to solve mathematical problems involving vectors and matrices, and able to interpret this concept from geometrical perspective.

LO2 Students are able to explain the relationship between the process of solving linear equations with matrix elimination (Gauss elimination, Gauss-Jordan elimination, and LU factorization) and able to solve systems of linear equations using the aforementioned elimination methods.

LO3 Students are able to explain the concepts of vector spaces and subspaces, able to interpret this concepts from the geometrical perspective, and able to apply this intuition from the geometrical perspective to solve related problems.

LO4 Students are able to explain the concepts of orthogonality and projection as well as able to solve the problems of projecting a vector into a particular subspaces by exploiting both least-square and Gram-Schmidt methods.

COURSE DESCRIPTION

This course covers fundamental understanding and solution to a system of linear equations, Ax=b, which appears in many engineering problems. The course also deals with the condition when Ax=b has many or no solutions.

TOPICS

1. Introduction to Vectors and Matrices

1.1 Vectors and Linear combination

1.2 Lengths, dot products, and cross products

1.3 Matrices

2. Simultaneous Linear Equations

2.1 Linear Equations

2.2 Linear Equations Concept and Matrix Equations
2.3 Elimination Concept

3. Elimination in Matrix Language
3.1 Gauss Elimination
3.2 Gauss Elimination with Permutation
3.3 Matrix Operation

4. Inverse Matrices
4.1 Gauss Jordan Elimination
4.2 Singular Matrices dan Matrix Invertibility
4.3 LU Factorization

5. Transpose and Permutation
5.1 Vectors Space, Column Space, and Subspace
5.2 Null Space (Solution to Ax=0)

6. Vector Spaces and Subspaces
6.1 Pivot Concept
6.2 Reduced Row Echelon Form
6.3 Four Fundamental Subspaces
6.4 Complete Solution to Ax=b

7. Orthogonality
7.1 Orthogonality, Orthogonal Vectors, and Orthogonal Subspaces
7.2 Projections
7.3 Least square

REFERENCES

[1] Strang, G. (2009). Introduction to Linear Algebra (4ed). Cambridge:Wellesley Cambridge Press.
[2] Poole, D. (2006). Linear Algebra: A Modern Introduction (2ed). Pacific Grove: Brooks-Cole Publishing.
[3] Strang, G. (2006). LinearAlgebra and its Applications (4ed).Cambridge: Wellesley Cambridge Press.