

Applications of Linear Algebra in Communication

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Abstract

Linear algebra has important role in engineering, but many people whom work in science and technology don't sufficient information about using it in them field, in this literature we try somewhat introduce applications of linear algebra in engineering, particularly in communication and relevancy it's concepts to phrases as Fourier Transform, least squares, transfer functions, matched filter and etc to show it's important role.

Some other mathematical subjects that are important for electrical engineering students include probability and stochastic processes, statistics, and discrete mathematics.

Keywords: Linear algebra, communication, vectors, matched filter, singular value decomposition

1. Introduction

Linear algebra (LA) has important role in engineering, but many people whom work in science and technology don't sufficient information about using it in them field, in this literature we try to introduce applications of linear algebra in engineering, particularly in communication and relevancy it's concepts to phrases as Fourier Transform, least squares, transfer functions, matched filter and etc to show it's important role. The aim of this paper is showing important role of LA with examples in communication.

This paper contains five part, first introduction, second basic concepts, third applications, forth conclusion and future research directions and finally references.

2. Basic concepts

In this part, we study the topics in linear algebra that will be needed in the rest of the literature.

We begin by discussing the building blocks of linear algebra: matrices and vectors.

Definition: a matrix is any rectangular array of numbers [1].

If a matrix A has m rows and n columns, we call A an m by n matrix. We refer to m by n as the order of the matrix. A typical m by n matrix A may be written as

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \quad (1)$$

The number in the i th row and j th column of A is called the ij th element of A and is written a_{ij} . Two matrices $A=[a_{ij}]$ and $B=[b_{ij}]$ are equal if only if A and B are of the same order and for all i and j , $a_{ij} = b_{ij}$.

Definition: a matrix is any matrix with only one column (that is, any $m \times 1$ matrix) may be thought of as a column vector. \mathcal{R}^m will denote the set of all m -dimensional column vectors.

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