

LINEAR ALGEBRA AND ITS APPLICATIONS UE19MA251

Linear Transformations



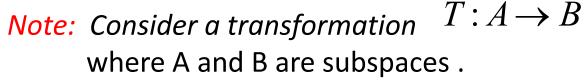
Definition:

A transformation T is said to be linear if it satisfy the rule of linearity.

i.e., A(cx+dy) = c A(x) + d A(y) for any scalar c,d are real constants.

Linear Transformations

Example: In linear system of equations Ax = b, Matrix A is a transformation from R^n to R^m .



- 1. A is the domain of the transformation.
- 2. B is the co domain of the transformation.
- 3. For any x in A, there exist Tx in B, here Tx is the image of T and x is the pre image of Tx



Linear Transformations



- 4. The set of all images is the subset of B is called Range of the transformation.
- 5. For all x in A such that Tx = 0 is called the Kernel of the transformation.
- 6. Dimension of the range is called rank and dimension of Kernel is called nullity.

Linear Transformations



Definition:

The space of all polynomials in t of degree n is a vector space called the <u>polynomial space</u> denoted by P_n .

 $P_n = \{ \text{ Its basis is } 1, t, t^2, \dots, t^n \text{ and dimension is } n+1. \}$

Linear Transformations

Example 1: The operation of differentiation is linear. It takes P_{n+1} to P_n . The column space is the whole of P_n and the null space is P_0 , the 1-dimensional space of all constants.



is linear. It takes P_n to P_{n+1} . The column space is a subspace of P_{n+1} and the null space is just the zero vector.



Linear Transformations

Example 3:

Multiplication by a fixed polynomial, say 3 + 4t is also a linear transformation.

Let p(t) =
$$a_0 + a_1 t + a_2 t^2 + + a_n t^n$$
 then

A p(t) =
$$(3+4t)$$
 p(t) = $3a_0 + ... + 4a_n t^{n+1}$.

This A sends P_n to P_{n+1} .





THANK YOU