## Coordinatization of Vectors

## 1. Ordered Basis:

The vector [2,5] in R2 can be expressed in terms of the standard basis vectors as

2e, t 5e2. In a non-zero vector space V

there are no order for the basis. This is

because set notation does not denote order.

£ bi, bi 3 = {bi, bi 3. However, to describe order,

we use (,). E.g. (bi, bi). We denoted an

ordered basis of n vectors in V by

B=(bi, bi, bi, bi).

## 2. Coordinatization of Basis:

and let B= (bi, bz, ... bn) be a basis for V.

Every vector V in V can be expressed in

the form V= ribi + rzbz + ... rnbn, for unique

scalar ri, rz, ... rn. The vector [ri, rz, ... rn]

in R° with V.

## 3. Coordinate Vector Relative to an Ordered Basis:

Let B= (bi, bz, ... bn) be an ordered basis for a finite dimensional vector space V, and let v= ribi trzbz t... rnbn. The vector [ri, rz, ... rn] is the coordinate vector of v relative to the ordered basis B, and is denoted by VB.

E.g. 1. Find the coordinate vectors of [1,-1] and of [4,-8] relative to the ordered basis B=([1,-1], [1,2]) of R2.

Solution:

[1,-1] = Y, [1,-1] + Y2[1,2] = 1 [1,-1] + Y2[1,2]

: [1,-1]8= [1,0]

[-1,-8] = Y. [1,-1] + Y2 [1,2]

-8=-1/+545 -1= 1/+15

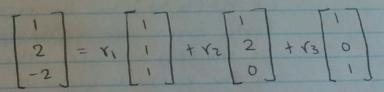
Y1= 2, Y2=-3

.. [-1, 8]<sub>8</sub>= [2,-3]

Fig. 2 Find the coordinate vector of [1,2,-2] relative to the ordered basis

B= ([1,1,1], [1,2,0], [1,0,1]).

Solutioni



 $Y_1 + Y_2 + Y_3 = 1$   $Y_1 + 2Y_2 + 0 = 2$  $Y_1 + 0 + Y_3 = -2$ 

1 1 1 1 1 1 1 2 0 2 1 1 0 1 -2

0 1 0 3

: [1,2,-2]B=[-4,3,2]

The procedure to find the coordinate vector of Vin Rn relative to an ordered basis B= (bi, bz, ... bn);

Step 1: Write vectors as column vectors in the form

Step 2: RREF the matrix to get [IIV8] where I is an nxn matrix.