Assignment 17

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Abstract—**This document explains the representation of transformations by matrix.**

Download all python codes from

https://github.com/harshachinta/EE5609−Matrix−
    Theory/tree/master/Assignments/Assignment17
    /code

and latex-tikz codes from

https://github.com/harshachinta/EE5609−Matrix−
    Theory/tree/master/Assignments/Assignment17

1 PROBLEM

Let T be a linear operator on $\mathbf{F^n}$, let $\mathbf{A}$ be the matrix of T in the standard ordered basis for $\mathbf{F^n}$, and let W be the subspace of $\mathbf{F^n}$ spanned by the column vectors of $\mathbf{A}$. What does W have to do with T ?

2 EXPLANATION

Refer Table 0.

Let $\{\alpha_1, \alpha_2, \cdots, \alpha_n\}$ be an ordered basis of $\mathbf{F^n}$	
Given	**Explanation**
T is a linear operator $\mathbf{F^n}$	As T is linear, $$T(\mathbf{x}) = \mathbf{Ax} \qquad (2.0.1)$$ $$\mathbf{A} = \begin{pmatrix} T\epsilon_1 & T\epsilon_2 & \cdots & T\epsilon_n \end{pmatrix} \qquad (2.0.2)$$ From equation (2.0.2), columns of $\mathbf{A}$ are the images of the standard basis elements of $\mathbf{F^n}$.
Range of T	$$\text{range}(T) = \{T\epsilon_1, T\epsilon_2, \cdots, T\epsilon_n\} \qquad (2.0.3)$$ From equation (2.0.2) and (2.0.3), columns of $\mathbf{A}$ generate the range of T.
W spanned by column vectors $\mathbf{A}$	Since any generating set contains a basis for the generated space, we can say that the columns of $\mathbf{A}$ contains a basis of the range of T. As W is spanned by column vectors of $\mathbf{A}$, we can say that W contains a basis for the range of T.

TABLE 0: Expanation