

EE5609: Matrix Theory

Assignment-12

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Abstract—This document has an example of finding the Transpose or adjoint T' of a linear operator T for a given function.

Download the latex-tikz codes from

<https://github.com/pranaya14014/EE5609/tree/master/Assignment12>

1 PROBLEM

Let, \mathbf{V} be the space of all $n \times n$ matrices over a field \mathbf{F} and let \mathbf{B} be a fixed $n \times n$ matrix. If T is the linear operator on \mathbf{V} defined by $T(\mathbf{A}) = \mathbf{AB} - \mathbf{BA}$, and if f is the trace function, what is $T'f$?

2 SOLUTION

$$T'f(\mathbf{A}) = f(T(\mathbf{A})) \quad (2.0.1)$$

$$= f(\mathbf{AB} - \mathbf{BA}) \quad (2.0.2)$$

$$= \text{trace}(\mathbf{AB} - \mathbf{BA}) \quad (2.0.3)$$

using $\text{trace}(\mathbf{AB}) = \text{trace}(\mathbf{BA})$ in (2.0.3),

$$T'f(\mathbf{A}) = \text{trace}(\mathbf{AB}) - \text{trace}(\mathbf{BA}) = 0 \quad (2.0.4)$$

Hence $T'f = 0$