

A Check of the Example

Here is a check:

$$(a_0 + a_1t + a_2t^2 + a_3t^3)' = a_1 + 2a_2t + 3a_3t^2$$

$$[a_0 + a_1t + a_2t^2 + a_3t^3]_E = \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \end{bmatrix}, [a_1 + 2a_2t + 3a_3t^2]_E = \begin{bmatrix} a_1 \\ 2a_2 \\ 3a_3 \end{bmatrix}$$

and so

$$[T(v)]_E = [T]_{EE}[v]_E \text{ becomes } \begin{bmatrix} a_1 \\ 2a_2 \\ 3a_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \end{bmatrix}$$

Differentiation by matrix multiplication!