Let $M_{m,n}(F)$ denote the linear space of $m \times n$ matrices with entries from a field $F$, and write $M_{n,n} \equiv M_n$. For a given $X = [x_{ij}] \in M_{m,n}(F)$, construct $\text{vec}(X) \in F^{mn}$ by stacking the columns of $X$, i.e., the entry of $\text{vec}(X)$ in position $(j-1)n+i$ is $x_{ij}$, $i = 1, \cdots, m$, $j = 1, \cdots, n$. Any linear mapping $L: M_{m,n}(F) \to M_{p,q}(F)$ is associated with a unique matrix $K(L) \in M_{pq,mn}(F)$ such that $\text{vec}(L(X)) = K(L)\text{vec}(X)$ for all $X \in M_{m,n}(F)$; one says that $K(L)$ is the matrix representing $L$. For given $A, B \in M_n(F)$, the author shows that the matrix representing the mapping $X \to (AXB +BXA)^T$ on $M_n(F)$ is symmetric. For a given $X \in M_n(C)$ and a given primary matrix function $f$, one may consider the linear map $Z \to [L_f(X, Z)]^T$ that takes $Z \in M_n$ into the transpose of the Fréchet derivative of $f$ at $X$ in the direction $Z$. The author shows that the matrix representing this map is symmetric, and he discusses the case $f(z) = e^z$ and two approximations to its Fréchet derivative.

References


Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

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