Let $M_{mn}(F)$ be the set of $m \times n$ matrices over a field F. The symbols A^*, $rk(A)$, $Im(A)$, and $M(A)$ will stand for the transpose or the conjugate transpose, the rank, the image, and the linear span of columns, respectively, of a matrix $A \in M_{mn}(F)$. Symbols $\sigma(A)$ and $\sigma_1(A)$ will denote the set of non-zero singular values (eigenvalues of the matrix AA^*) and the maximal singular value for real and complex matrices.

The following order relations on the set $M_{mn}(F)$ are often considered in connection with different problems in Algebra and Statistics.

- Minus order: $A \overset{-}{<} B$ iff $rk(B - A) = rk(B) - rk(A)$
- Drazin star order: $A \overset{*}{<} B$ iff $A^*A = A^*B$ and $AA^* = BA^*$
- Left-star and right-star partial orderings: $A {*<}\, B$ iff $A^*A = A^*B$ and $M(A) \subseteq M(B)$, $A <{*} B$ iff $AA^* = BA^*$ and $M(A^*) \subseteq M(B^*)$
- Singular value partial orderings: $A \overset{\sigma}{<} B$ iff $A \overset{-}{<} B$ and $\sigma(A) \subseteq \sigma(B)$, $A \overset{\sigma_1}{<} B$ iff $A \overset{-}{<} B$ and $\sigma_1(A) \leq \sigma_1(B)$
- Diamond partial ordering: $A \overset{\diamond}{<} B$ iff $Im(A) \subseteq Im(B)$, $Im(A^*) \subseteq Im(B^*)$, and $AA^*A = AB^*A$.

The map $T : M_{mn}(F) \to M_{mn}(F)$ is called monotone with respect to a given matrix partial order $\prec$ if for each pair $A, B \in M_{mn}(F)$ the relation $A \prec B$ implies $T(A) \prec T(B)$.

This work is based on a joint paper with Anna A. Alieva where we show that monotone linear transformations on matrices with respect to $\overset{-}{<}$, $\overset{*}{<}$, $*<$, $<*$, $\overset{\diamond}{<}$, $\overset{\sigma}{<}$, $\overset{\sigma_1}{<}$-partial orders are invertible and provide a complete characterization of such transformations. In particular it turns out that the thinner the matrix partial order under consideration is the smaller is the class of corresponding monotone linear transformations.