Step-1

If matrix A is invertible and the matrix factorization for A is as follows

$$A = U\Sigma V^T$$

Consider $U^T U = I$, so we can write

$$\begin{aligned} A &= U\Sigma U^T U V^T \\ &= \left(U\Sigma U^T\right)\left(UV^T\right) \end{aligned}$$

Step-2

Consider $Q = UV^T$, since

$$\begin{aligned} Q^T Q &= \left(VU^T\right)\left(UV^T\right) \\ &= VU^T UV^T \\ &= I \end{aligned}$$

The factor $Q = UV^T$ is orthogonal.

Consider $S' = U\Sigma U^T$, since

$$\begin{aligned} S' &= QSQ^T \\ &= \sqrt{AA^T} \\ &= U\Sigma U^T \end{aligned}$$

The factor $S' = U\Sigma U^T$ is the symmetric and positive semidefinite.

Step-3

Therefore, we can split $A = U\Sigma V^T$ in the reverse polar decomposition as $\boxed{A = QS'}$, here

Q is orthogonal and *S*â€™ is symmetric positive semidefinite.