

Definition 1. An orthogonal matrix is a square matrix with real entries whose columns and rows are orthogonal unit vectors, or

$$QQ^T = I \tag{1}$$

0.1 Properties

- $\det(Q) = \pm 1$
- Unitary Transformation (i.e. $u \cdot v = Qu \cdot Qv$)

0.2 Important Orthogonal Decompositions

- QR: $M = QR$ (Q orthogonal, R upper-triangular)
- SVD: $M = U\Sigma V^T$ (U and V orthogonal, Σ diagonal)
- Eigendecomposition: $S = Q\Lambda Q^T$ (S symmetric, Q orthogonal, Λ diagonal)
- Polar Decomposition: . . .