Special Matrices

Mathematics

Named matrix types, their definitions and the property each one buys you.

Structure you can exploit rather than compute.

Name	Definition	Key property
Symmetric	Equals its own transpose	Real eigenvalues
Orthogonal	Columns are orthonormal	Inverse is the transpose
Diagonal	Off-diagonal entries all 0	Powers act entrywise
Triangular	Zeros on one side	det is the diagonal product
Idempotent	$A^2 = A$	Eigenvalues are 0 or 1
Nilpotent	A^k = 0 for some k	Every eigenvalue is 0
Singular	det(A) = 0	Nontrivial null space

The spectral theorem: a real symmetric matrix always has an orthonormal eigenbasis and every eigenvalue is real.