# 2 Linear Algebra

linearity

## 2.1 NUMBERS, VECTORS, AND MATRICES

numbers
   integers
   real
   complex a+bi 2D
   quaternion a+bi+cj+dk rotations
   vectors
   norms L2 L1
   dot, cross products
   Einstein summation notation
   orthogonalization
   Gram–Schmidt
   matrices
   inner, outer products
   tensors

## 2.2 SYSTEMS OF EQUATIONS

Ax=b
   inverse
   Gauss-Jordan, row reduction
   Ax=Ib
   Ix=A−1b
   iterative
   unitary orthogonal
   Hermitian self-adjoint, real eigenvalues
   positive definite, real positive eigenvalues
   sparse
   eigenvectors, eigenvalues
   Ax = Lx

determinant
Leibniz formula
Einstein summation
product eigenvalues
volume
char poly
Ax = Lx
(A-Li)x = 0
non-trivial solution
det(A-Li) = 0
pseudo-inverse
singular values
SVD

## 2.3 FUNCTIONS OF MATRICES

## 2.4 SELECTED REFERENCES

[Strang, 2016] Strang, G. (2016). *Introduction to linear algebra, 5th edn. Wellesley*.

   A classic reference on linear algebra.

[Golub & Van Loan, 2013] Golub, Gene H, & Van Loan, Charles F. (2013). *Matrix Computations*. JHU press.

   A classic reference on matrix computations.

[Boyd & Vandenberghe, 2004] Boyd, Stephen, & Vandenberghe, Lieven. (2004). *Convex Optimization*. Cambridge: Cambridge University Press.

   The wonders of convex functions.

## 2.5 PROBLEMS