Mathematics: Linear Algebra

Course Description

Linear algebra is a fundamental subject in mathematics. Its historical origin lies in the development of solution techniques for systems of linear equations arising from geometric problems. Numerous scientific and engineering applications can be solved using its methods. This course introduces the foundations of linear algebra and its basic notions like vectors and matrices. It then builds upon this foundation by introducing the derivation of solution techniques for problems in analytical geometry.

Contents

1. Foundations
   1. Systems of Linear Equations
   2. Matrices: Basic Terms
   3. Matrix algebra
   4. Matrices as compact representations of linear equations
   5. Inverse and trace
2. Vector Spaces
   1. Definition
   2. Linear Combination and Linear Dependance
   3. Basis, Linear Envelope, and Rank
3. Linear and Affine Mapping
   1. Matrix Representation of Linear Mappings
   2. Image and Kernel
   3. Affine Spaces and Subspaces
   4. Affine Mapping
4. Analytical Geometry
   1. Norm
   2. Scalar Product
   3. Orthogonal Projections
   4. Outlook: Complex Numbers
5. Matrix Decomposition
   1. Determinant
   2. Eigenvalues and Eigenvectors
   3. Cholesky Decomposition
   4. Eigenvalue Decomposition and Diagonalisation
   5. Singular Value Decomposition