

NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - Matrix Theory

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Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course introduction and properties of matrices
Lecture 2 - Vector spaces
Lecture 3 - Basis, dimension
Lecture 4 - Linear transforms
Lecture 5 - Fundamental subspaces of a matrix
Lecture 6 - Fundamental theorem of linear algebra
Lecture 7 - Properties of rank
Lecture 8 - Inner product
Lecture 9 - Gram-schmidt algorithm
Lecture 10 - Orthonormal matrices definition
Lecture 11 - Determinant
Lecture 12 - Properties of determinants
Lecture 13 - Introduction to norms and inner products
Lecture 14 - Vector norms and their properties
Lecture 15 - Applications and equivalence of vector norms
Lecture 16 - Summary of equivalence of norms
Lecture 17 - Dual norms
Lecture 18 - Properties and examples of dual norms
Lecture 19 - Matrix norms
Lecture 20 - Matrix norms: Properties
Lecture 21 - Induced norms
Lecture 22 - Induced norms and examples
Lecture 23 - Spectral radius
Lecture 24 - Properties of spectral radius
Lecture 25 - Convergent matrices, Banach lemma
Lecture 26 - Recap of matrix norms and Levy-Desplanques theorem
Lecture 27 - Equivalence of matrix norms and error in inverses of linear systems
Lecture 28 - Errors in inverses of matrices
Lecture 29 - Errors in solving systems of linear equations

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- Lecture 30 - Introduction to eigenvalues and eigenvectors
- Lecture 31 - The characteristic polynomial
- Lecture 32 - Solving characteristic polynomials, eigenvectors properties
- Lecture 33 - Similarity
- Lecture 34 - Diagonalization
- Lecture 35 - Relationship between eigenvalues of BA and AB
- Lecture 36 - Eigenvector and principle of biorthogonality
- Lecture 37 - Unitary matrices
- Lecture 38 - Properties of unitary matrices
- Lecture 39 - Unitary equivalence
- Lecture 40 - Schur's triangularization theorem
- Lecture 41 - Cayley-Hamilton theorem
- Lecture 42 - Uses of cayley-hamilton theorem and diagonalizability revisited
- Lecture 43 - Normal matrices: Definition and fundamental properties
- Lecture 44 - Fundamental properties of normal matrices
- Lecture 45 - QR decomposition and canonical forms
- Lecture 46 - Jordan canonical form
- Lecture 47 - Determining the Jordan form of a matrix
- Lecture 48 - Properties of the Jordan canonical form - Part 1
- Lecture 49 - Properties of the Jordan canonical form - Part 2
- Lecture 50 - Properties of convergent matrices
- Lecture 51 - Polynomials and matrices
- Lecture 52 - Other canonical forms and factorization of matrices: Gaussian elimination and LU factorization
- Lecture 53 - LU decomposition
- Lecture 54 - LU decomposition with pivoting
- Lecture 55 - Solving pivoted system and LDM decomposition
- Lecture 56 - Cholesky decomposition and uses
- Lecture 57 - Hermitian and symmetric matrix
- Lecture 58 - Properties of hermitian matrices
- Lecture 59 - Variational characterization of Eigenvalues: Rayleigh-Ritz theorem
- Lecture 60 - Variational characterization of eigenvalues (Continued...)
- Lecture 61 - Courant-Fischer theorem
- Lecture 62 - Summary of Rayleigh-Ritz and Courant-Fischer theorems
- Lecture 63 - Weyl's theorem
- Lecture 64 - Positive semi-definite matrix, monotonicity theorem and interlacing theorems
- Lecture 65 - Interlacing theorem - I
- Lecture 66 - Interlacing theorem - II (Converse)
- Lecture 67 - Interlacing theorem (Continued...)
- Lecture 68 - Eigenvalues: Majorization theorem and proof

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- Lecture 69 - Location and perturbation of Eigenvalues - Part 1: Dominant diagonal theorem
- Lecture 70 - Location and perturbation of Eigenvalues - Part 2: Gersgorin's theorem
- Lecture 71 - Implications of Gersgorin disc theorem, condition of eigenvalues
- Lecture 72 - Condition of eigenvalues for diagonalizable matrices
- Lecture 73 - Perturbation of eigenvalues Birkhoff's theorem Hoffman-Weiland theorem
- Lecture 74 - Singular value definition and some remarks
- Lecture 75 - Proof of singular value decomposition theorem
- Lecture 76 - Partitioning the SVD
- Lecture 77 - Properties of SVD
- Lecture 78 - Generalized inverse of matrices
- Lecture 79 - Least squares
- Lecture 80 - Constrained least squares