

Spatii si transformari liniare

Examen de doctorat.- Programa disciplinei – Prof. Dr. Ing. Daniel Ioan

1. Spatii vectoriale, transformari si ecuatii liniare

Spatii si subsatii vectoriale

Dependenta liniara, baze, dimensiune. Rangul unei matrice.

Cele patru spatii fundamentale ale unei matrice.

Transformari liniare

2. Produs scalar. Ortogonalitate

Produs scalar. Proiectii.

Aproximarea cu cele mai mici patrate

Baze ortogonale, Matrice ortogonale. Ortogonalizare. Gram-Schmidt.

3. Vectori si valori proprii. Functii de matrice

Forma diagonal a unei matrice

Functii de matrice – exponentiala matricelor. Solutia sistemului linar de ecuatii diferentiale

Matrice complexe (simetrice, hermitice, ortogonale, unitare)

Transformari de similitudine

4. Matrice pozitiv definite

Puncte extreme. Verificarea pozitivitatii

Matrice pozitiv definite, semidefinite si indefinite

Principul minimului

5. Calcule cu matrice

Rezolvarea sistemelor liniare

Norme si numarul de conditionare

Calculul valorilor proprii

Rezolvarea iterativa a sistemelor liniare

Factorizarea matricelor. Forme speciale de matrice

Forma Jordan

Descompunerea cu valori singulare (SVD)

Pseudoinversa unei matrice

Biblioteci matematice pentru calcule algebrice – BLAS, LINPACK, MATLAB

Rezolvarea sistemelor de ecuatii liniare de mari dimensiuni cu matrice rare

Rezolvarea paralela si distribuita a sistemelor liniare

Sistem liniare invariante in timp – simulare

5. Spatii liniare infinit dimensionale (optional)

Spatii liniare, operatori liniari, functionale liniare

Spatii liniare normate - Banach, completarea

Spatii Hilbert, ortogonalitate, cea mai buna aproximare

Adjunctul unui portator linar si continuu, operatori autoadjuncti

Proiectori, baze ortonormate, operatori compacti pe spatii Hilbert

Integrala Lebesgue, spatiile L_p , teoria masurii

Elemente de teoria distributiilor

Transformata Fourier. Spatii Sobolev

Aplicatii in electromagnetism (rezolvarea PDE eliptice, FEM).

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