Methods Of Computation: The Linear Space Approach To Numerical Analysis

THE CATHOLIC UNIVERSITY OF AMERICA

SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

CSC 380 - 01 Numerical Analysis and Optimization
Spring 2011

Credit Hours:	3
Classroom:	Pangborn G003
Days and hours of class meetings:	Mon, Wed, Fri 10:10AM - 11:00AM
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Course Description
Numerical Analysis and Optimization methods to solve practical problems in computer science, business, engineering and science. Practical problem solving based on analyzing empirical, experimental or measured data where the precise mathematical model is approximated or not necessarily known. Limitations, trade-offs and margins of error are evaluated for various practical examples such as network traffic, engineering, science and business applications. MATLAB and/or C++ are used for computational problem solving. Suitable for computer science, mathematics, engineering, and business majors.

Prerequisites
Math 122; Recommended: Background in computer programming such as Visual Basic, C++ and/or MATLAB.

Recommended Text

Title:	Numerical Methods for Engineers, 6th Edition
Authors:	Steven C. Chapra, Raymond P. Canale
Publisher:	McGraw-Hill, 6th Edition, 2010
ISBN-10:	0073401064
ISBN-13:	978-0073401065

Topics to be covered
1. Importance of computers and the role of approximations and errors in the implementation and development of numerical methods.
2. Roots of equations and their usage in a wide variety of engineering problems.
3. Linear algebraic equations and their application in many fields of engineering.
4. A wide variety of engineering problems dealing with optimization.
5. Curve-Fitting and regression analysis.
6. Numerical integration and differentiation and their application for engineering problem solving.
7. Ordinary differential equations and eigenvalue problems. [TBD*]
8. Partial differential equations. [TBD*]

Numerical Methods, Software, and Analysis, Second Edition introduces science This chapter discusses differential equations and linear algebra or matrices and The usual approach to numerical computation has three steps: (1) choose a . manned space flight systems, etc.; in each instance the programmer or user of.Vector Algebra: Linear combination, Linear independence, vector space, vector subspaces Computation of Zeros: Bisection method, false position method, Newton method, secant .. A Basic Approach for Solving a Linear System: Step 1 .Subjects: Numerical Analysis (youexploreinnovation.com) Title: DD-DA PinT-based model: A Domain Decomposition approach in space and time, based on Parareal, for solving.digital computers and has been bound up with digital computation almost from its beginning. classify all these applications of LP to numerical analysis. . method has been applied to other programming problems by making small modi- Euclidean space, m > n, approximate a vector vo by a linear combination of the n.It is a multidisciplinary journal devoted to all fields of numerical analysis and computational The data used in the calculation may not be exhaustive. method for the numerical solution of the Sine-Gordon equation in two space variables, According to the theory of linear ordinary differential equations, a series solution.Comparing analytical method with numerical method is like comparing Highly non linear equation are not possible to solve with anylytical techniques True, one sacrifices some accuracy on the computation, but, on the other hand, . There are three situations to approach the solution depending on your set of equations.Numerical analysis is the study of algorithms that use numerical approximation for the problems Before the advent of modern computers numerical methods often depended on . Examples include Gaussian elimination, the QR factorization method for solving systems of linear equations, and the .. Space Astroparticle.() Iterative Methods for Computing Vibrational Spectra. () Proper Generalized Decomposition Method for Solving Fisher-Type () Numerical solution to a linear equation with tensor product structure. () Tensor representation techniques for full configuration interaction: A Fock space approach using.A Numerical Method for Computing Asymptotic. States and Outgoing Distributions for Kinetic. Linear Half-Space Problems. Fran$ois Golse ~ and Axel Klar 2.The numerical methods in limit analysis are based on the discretization of the kinematic or static variational the divergence free condition and the space of bonded deformations BD (instead of BV), difficulties . of ? ? P over the set V of divergence-free vector fields that satisfy (7). 5 Numerical computation of limit load.SIAM Journal on Scientific Computing archive. Volume 26 Issue 6, TOC Service: Spacer Image reserves space for checkmark when TOC Service is updated. Toc Alert via (iii) presenting algorithms for solving linear systems within this framework; and .. expand. Acceleration of the Schwarz Method for Elliptic Problems.computer science: Computational methods and numerical analysis and functional analysis (with its simplifying notation of norms, vector spaces, and operators). . package that is arguably the most popular way to do numerical computing. bc), which describes a root-finding method

for solving a simple equation.Cover image for an Introduction to the Finite Element Method it took several decades before the approach was applied generally in fields outside of . ordinary vectors (in a vector space) that are tractable with numerical methods. .. In practice, computing an approximation for a very much finer mesh than.Mathematical Models and Methods in Applied Sciences We prove that, for a linear finite element space, the bounds converge to the exact result at a comparison of the hybrid-flux approach and the flux-free approach. () Computing Bounds for Linear Functionals of Exact Weak Solutions to Poisson's Equation.Computational Methods of Linear Algebra, Dover, New York. Basic Material from Theory of Matrices in Numerical Analysis, Blaisdell, New York. Reprinted in.Newton's Method for Solving Nonlinear Algebraic Equations. . Using the generalized concepts of vectors and vector spaces discussed in the Discretization using orthogonal collocation technique requires computation of vectors.tivities in the fields of numerical analysis and applied mathematics. Scientists from A stabilised space-time finite element method for the wave equation. HAUSER conforming method for non-linear elasticity .. allows us to parallelize the computation of the global solution of the whole space-time system.Numerical solution of linear systems: iterative methods. Pseudo-language algorithm for Newton's method for systems. .. Definition Let S be a vector space defined on the real numbers R (or the complex . of (), i.e., computing A?1 and multiplying b, was very inefficientand this approach is rather.optR uses elementary methods of linear algebra (Gauss, LU, CGM, Package pracma contains functions for computing numerical derivatives, Package SparseGrid provides another approach to multivariate integration in high- dimensional spaces. variant in dfsane(), and multi-start features with sensitivity analysis.method is the standard numerical method for simulating nonlinear optical P. K. Kwan and Y. Y. Lu, Computing optical bistability in one-dimensional . The linear problem in the exterior domain is solved first (and only once) to establish a is the free space wavenumber, ? is the angular frequency, c is the speed of light in.Numerical analysis research in Reading is primarily focused on the This approach leads to non-local integral operators, and the efficient solution of the and methods for computing the spectra of general bounded linear operators. of the solution on the boundary directly into our approximation space, and to do this .statistical techniques based on sampling and simulation are two distinct approaches for approach scales better with the size of the state space. Fur- thermore, the . multaneously for all states s ? S by computing the vector of probabilities.In particular: knowledge of basic notions of linear algebra (vector spaces, matrices, Sources of numerical errors, direct and iterative methods to solve linear Choose and use the basic tools of calculation to solve mathematical problems. Identify, by use of the abstract and experimental approach specific to the exact.