

# Numerical methods and algorithms

1. Special format of graph description was constructed. It allows user to pay no attention to the way how solver treats the topology of vascular graph.

2. Conservative finite-difference scheme with second order of approximation on each arch of graph was taken as a base. At the same time scheme is homogeneous, so it does not depends upon concrete arch.

3. Two different variants of finite-difference schemes provided for better reliability of numerical calculations.

4. The total non-linear system of equations is solved with help of iteration methods (Newton method, successive iterations on coefficients of equations).

5. The obtained linear system of equations is solved mainly by direct methods.

$$\hat{p}_j^k + As_j^3 \hat{\rho}_{j+1}^k + Bs_j^1 \hat{u}_{j-1}^k + Bs_j^2 \hat{u}_j^k + Bs_j^3 \hat{u}_{j+1}^k = -Fs_j$$

$$1_j^k = -\left(\frac{u_{j-1}^k}{2} + \frac{a_{j-1/2}^k}{h}\right) \frac{\sigma_1 \tau}{h} \theta_{j-1}^k,$$

$$2_j^k = (1 + (a_{j+1/2}^k + a_{j-1/2}^k) \frac{\sigma_1 \tau}{h^2}) G$$

$$3_j^k = \left(\frac{u_{j+1}^k}{2} - \frac{a_{j+1/2}^k}{h}\right) \frac{\sigma_1 \tau}{h} \theta_{j+1}^k,$$

$$Bs_j^1 = -\frac{\sigma_1 \tau}{2h} s_{j-1}^k,$$

$$Bs_j^2 = 0,$$

$$Bs_j^3 = \frac{\sigma_1 \tau}{2h} s_{j+1}^k,$$

$$-\bar{s} + (s_{j+1}^k u_{j+1}^k - s_{j-1}^k u_{j-1}^k) \frac{\sigma_1 \tau}{2h} + (\bar{s}_{j+1} \bar{u}_{j+1} - \bar{s}_{j-1} \bar{u}_{j-1}) \frac{(1-\sigma_1)\tau}{2h} -$$

$$-(a_{j+1}^k s_{j+1}^k - (a_{j+1/2}^k + a_{j-1/2}^k) s_j^k + a_{j-1/2}^k s_{j-1}^k) \frac{\sigma_1 \tau}{h^2} -$$

$$-(\bar{a}_{j+1/2} \bar{s}_{j+1} - (\bar{a}_{j+1/2} + \bar{a}_{j-1/2}) \bar{s}_j + \bar{a}_{j-1/2} \bar{s}_{j-1}) \frac{(1-\sigma_1)\tau}{h^2}.$$

# Numerical Calculations And Algorithms

**Gisela Engeln-Müllges, Frank Uhlig**



## **Numerical Calculations And Algorithms:**

Numerical Algorithms with C Giesela Engeln-Müllges, Frank Uhlig, 1996-07-02 CD ROM contains all computer codes a compiler and a test bed of programs and data for most of the algorithms      Numerical Calculations and Algorithms Royce Beckett, James Hurt, 1983      **Numerical Methods** Anne Greenbaum, Tim P. Chartier, 2012-04-01 A rigorous and comprehensive introduction to numerical analysis Numerical Methods provides a clear and concise exploration of standard numerical analysis topics as well as nontraditional ones including mathematical modeling Monte Carlo methods Markov chains and fractals Filled with appealing examples that will motivate students the textbook considers modern application areas such as information retrieval and animation and classical topics from physics and engineering Exercises use MATLAB and promote understanding of computational results The book gives instructors the flexibility to emphasize different aspects design analysis or computer implementation of numerical algorithms depending on the background and interests of students Designed for upper division undergraduates in mathematics or computer science classes the textbook assumes that students have prior knowledge of linear algebra and calculus although these topics are reviewed in the text Short discussions of the history of numerical methods are interspersed throughout the chapters The book also includes polynomial interpolation at Chebyshev points use of the MATLAB package Chebfun and a section on the fast Fourier transform Supplementary materials are available online Clear and concise exposition of standard numerical analysis topics Explores nontraditional topics such as mathematical modeling and Monte Carlo methods Covers modern applications including information retrieval and animation and classical applications from physics and engineering Promotes understanding of computational results through MATLAB exercises Provides flexibility so instructors can emphasize mathematical or applied computational aspects of numerical methods or a combination Includes recent results on polynomial interpolation at Chebyshev points and use of the MATLAB package Chebfun Short discussions of the history of numerical methods interspersed throughout Supplementary materials available online      *Control Perspectives on Numerical Algorithms and Matrix Problems* Amit Bhaya, Eugenius Kaszkurewicz, 2006-03-01 This book organizes the analysis and design of iterative numerical methods from a control perspective A variety of applications are discussed including iterative methods for linear and nonlinear systems of equations neural networks for linear and quadratic programming problems and integration and shooting methods for ordinary differential equations      **Compact Numerical Methods for Computers** John C. Nash, 1990-01-01 This second edition of Compact Numerical Methods for Computers presents reliable yet compact algorithms for computational problems As in the previous edition the author considers specific mathematical problems of wide applicability develops approaches to a solution and the consequent algorithm and provides the program steps He emphasizes useful applicable methods from various scientific research fields ranging from mathematical physics to commodity production modeling While the ubiquitous personal computer is the particular focus the methods have been implemented on computers as small as a programmable

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*Numerical Algorithms* Justin Solomon,2015-06-24 Numerical Algorithms Methods for Computer Vision Machine Learning and Graphics presents a new approach to numerical analysis for modern computer scientists Using examples from a broad base of computational tasks including data processing computational photography and animation the textbook introduces numerical modeling and algorithmic design

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*Numerical Algorithms* E. V. Krishnamurthy, 1986      [Practical Numerical Methods](#) Michael C. Kohn, 1987      *An Introduction to Numerical Analysis* Endre Süli, David F. Mayers, 2003-08-28 Numerical analysis provides the theoretical foundation for the numerical algorithms we rely on to solve a multitude of computational problems in science Based on a successful course at Oxford University this book covers a wide range of such problems ranging from the approximation of functions and integrals to the approximate solution of algebraic transcendental differential and integral equations Throughout the book particular attention is paid to the essential qualities of a numerical algorithm stability accuracy reliability and efficiency The authors go further than simply providing recipes for solving computational problems They carefully analyse the reasons why methods might fail to give accurate answers or why one method might return an answer in seconds while another would take billions of years This book is ideal as a text for students in the second year of a university mathematics course It combines practicality regarding applications with consistently high standards of rigour

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