Example 1

A liquid-liquid extraction process conducted in the Electrochemical Materials Laboratory involved the extraction of nickel from the aqueous phase into an organic phase. A typical set of experimental data from the laboratory is given below.

Ni AQUEOUS PHASE, a (g/l)	2	2.5	3
Ni ORGANIC PHASE, g (g/l)	8.57	10	12

ASSUMING g IS THE AMOUNT OF Ni IN THE ORGANIC PHASE AND a IS THE AMOUNT OF Ni IN THE AQUEOUS PHASE, THE QUADRATIC INTERPOLANT THAT ESTIMATES g IS GIVEN BY

$$g = x_1 a^2 + x_2 a + x_3, 2 \leq a \leq 3$$

THE SOLUTION FOR THE UNKNOWNS x_1, x_2, AND x_3 IS GIVEN BY

$$\begin{bmatrix} 4 & 2 & 1 \\ 6.25 & 2.5 & 1 \\ 9 & 3 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 8.57 \\ 10 \\ 12 \end{bmatrix}$$

FIND THE VALUES OF x_1, x_2, AND x_3 USING THE GAUSS-SEIDEL METHOD. ESTIMATE THE AMOUNT OF NICKEL IN THE ORGANIC PHASE WHEN 2.3 G/L IS IN THE AQUEOUS PHASE USING QUADRATIC INTERPOLATION. USE

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

AS THE INITIAL GUESS AND CONDUCT TWO ITERATIONS.

Solution:-

REWRITING THE EQUATIONS GIVES

$$x_1 = \frac{8.57 - 2x_2 - x_3}{4}$$

$$x_2 = \frac{10 - 6.25x_1 - x_3}{2.5}$$

$$x_3 = \frac{12 - 9x_1 - 3x_2}{1}$$

ITERATION #1
GIVEN THE INITIAL GUESS OF THE SOLUTION VECTOR AS

Numerical Analysis Problems And Solutions

Mark Steyvers

Numerical Analysis Problems And Solutions:

Numerical Methods M. K. Jain,Satteluri R. K. Iyengar,R. K. Jain,2007 Is An Outline Series Containing Brief Text Of Numerical Solution Of Transcendental And Polynomial Equations System Of Linear Algebraic Equations And Eigenvalue Problems Interpolation And Approximation Differentiation And Integration Ordinary Differential Equations And Complete Solutions To About 300 Problems Most Of These Problems Are Given As Unsolved Problems In The Authors Earlier Book User Friendly Turbo Pascal Programs For Commonly Used Numerical Methods Are Given In The Appendix This Book Can Be Used As A Text Help Book Both By Teachers And Students *Numerical Analysis Problem Solver* Research and Education Association,1983-01-01 The Problem Solvers are an exceptional series of books that are thorough unusually well organized and structured in such a way that they can be used with any text No other series of study and solution guides has come close to the Problem Solvers in usefulness quality and effectiveness Educators consider the Problem Solvers the most effective series of study aids on the market Students regard them as most helpful for their school work and studies With these books students do not merely memorize the subject matter they really get to understand it Each Problem Solver is over 1 000 pages yet each saves hours of time in studying and finding solutions to problems These solutions are worked out in step by step detail thoroughly and clearly Each book is fully indexed for locating specific problems rapidly An essential subject for students in mathematics computer science engineering and science The 19 chapters cover basic as well as advanced methods of numerical analysis A large number of related applications are included Numerical Methods J. Douglas Faires,Richard L. Burden,1998 This text emphasizes the intelligent application of approximation techniques to the type of problems that commonly occur in engineering and the physical sciences The authors provide a sophisticated introduction to various appropriate approximation techniques they show students why the methods work what type of errors to expect and when an application might lead to difficulties and they provide information about the availability of high quality software for numerical approximation routines The techniques covered in this text are essentially the same as those covered in the Sixth Edition of these authors top selling Numerical Analysis text but the emphasis is much different In Numerical Methods Second Edition full mathematical justifications are provided only if they are concise and add to the understanding of the methods The emphasis is placed on describing each technique from an implementation standpoint and on convincing the student that the method is reasonable both mathematically and computationally **Numerical Methods for the Solution of Ill-Posed Problems** A.N. Tikhonov,A. Goncharsky,V.V. Stepanov,Anatoly G. Yagola,2013-03-09 Many problems in science technology and engineering are posed in the form of operator equations of the first kind with the operator and RHS approximately known But such problems often turn out to be ill posed having no solution or a non unique solution and or an unstable solution Non existence and non uniqueness can usually be overcome by settling for generalised solutions leading to the need to develop regularising algorithms The theory of ill posed problems has advanced greatly since A N Tikhonov laid its

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and boundary value problems BVPs **Problem Solving in Chemical Engineering with Numerical Methods** Michael B. Cutlip,Mordechai Shacham,1999 A companion book including interactive software for students and professional engineers who want to utilize problem solving software to effectively and efficiently obtain solutions to realistic and complex problems An Invaluable reference book that discusses and Illustrates practical numerical problem solving in the core subject areas of Chemical Engineering Problem Solving in Chemical Engineering with Numerical Methods provides an extensive selection of problems that require numerical solutions from throughout the core subject areas of chemical engineering Many are completely solved or partially solved using POLYMATH as the representative mathematical problem solving software Ten representative problems are also solved by Excel Maple Mathcad MATLAB and Mathematica All problems are clearly organized and all necessary data are provided Key equations are presented or derived Practical aspects of efficient and effective numerical problem solving are emphasized Many complete solutions are provided within the text and on the CD ROM for use in problem solving exercises BOOK JACKET Title Summary field provided by Blackwell North America Inc All Rights Reserved **Topics in Numerical Analysis** G. Alefeld,Xiaojun Chen,2001-09-11 This collection of papers on numerical analysis with special emphasis on nonlinear problems covers a broad spectrum of fields Several papers are involved in applying numerical methods for proving the existence of solutions of nonlinear problems e g of boundary problems or of obstacle problems Naturally the solution of linear and nonlinear problems by iterative methods is the subject of a couple of papers Here topics like the fast verification of solutions of monotone matrix equations the convergence of linear asynchronous iteration with spectral radius of modulus one or aggregation and disaggregation methods for p cyclic Markov chains are treated On the other hand papers involved in optimization problems can be found Nearly all fields of modern numerical analysis are touched by at least one paper *Numerical Analysis of Systems of Ordinary and Stochastic Differential Equations* Sergej S. Artemiev,Tatjana A. Averina,1997 This book deals with numerical analysis of systems of both ordinary and stochastic differential equations The first chapter is devoted to numerical solution problems of the Cauchy problem for stiff ordinary differential equation ODE systems by Rosenbrock type methods RTMs Here general solutions of consistency equations are obtained which lead to the construction of RTMs from the first to the fourth order The second chapter deals with statistical simulation problems of the solution of the Cauchy problem for stochastic differential equation SDE systems The mean square convergence theorem is considered as well as Taylor expansions of numerical solutions Also included are applications of numerical methods of SDE solutions to partial differential equations and to analysis and synthesis problems of automated control of stochastic systems *Introduction to Numerical Analysis* Francis Begnaud Hildebrand,1987-01-01 The ultimate aim of the field of numerical analysis is to provide convenient methods for obtaining useful solutions to mathematical problems and for extracting useful information from available solutions which are not expressed in tractable forms This well known highly respected volume provides an introduction to the fundamental processes

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Studies in Numerical Analysis 2 James McDonough Ortega,Werner Carl Rheinboldt,1970 **Numerical Methods** Mahinder Kumar Jain,S. R. K. Iyengar,Rajinder Kumar Jain,1994

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