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

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

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

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Explorations In Numerical Analysis: Python Edition James V Lambers,Amber C Sumner Mooney,Vivian Ashley Montiforte,2021-01-14 This textbook is intended to introduce advanced undergraduate and early career graduate students to the field of numerical analysis This field pertains to the design analysis and implementation of algorithms for the approximate solution of mathematical problems that arise in applications spanning science and engineering and are not practical to solve using analytical techniques such as those taught in courses in calculus linear algebra or differential equations Topics covered include computer arithmetic error analysis solution of systems of linear equations least squares problems eigenvalue problems nonlinear equations optimization polynomial interpolation and approximation numerical differentiation and integration ordinary differential equations and partial differential equations For each problem considered the presentation includes the derivation of solution techniques analysis of their efficiency accuracy and robustness and details of their implementation illustrated through the Python programming language This text is suitable for a year long sequence in numerical analysis and can also be used for a one semester course in numerical linear algebra   *Studies in Numerical Analysis 2 Numerical Solutions of Nonlinear Problems a Collection of Papers Presented at Symposia in Numeial* United States,1970   Handbook of Numerical Analysis Philippe G. Ciarlet,Jacques-Louis Lions,1990 This series of volumes covers all the major aspects of numerical analysis serving as the basic reference work on the subject Each volume concentrates on one to three particular topics Each article written by an expert is an in depth survey reflecting up to date trends in the field and is essentially self contained The handbook will cover the basic methods of numerical analysis under the following general headings solution of equations in Rn finite difference methods finite element methods techniques of scientific computing optimization theory and systems science It will also cover the numerical solution of actual problems of contemporary interest

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