

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 UNKNOWN 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

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

ITERATION #1

GIVEN THE INITIAL GUESS OF THE SOLUTION VECTOR AS

Numerical Analysis Problems And Solutions

Wolfgang Guggemos



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Table of Contents Numerical Analysis Problems And Solutions

1. Understanding the eBook Numerical Analysis Problems And Solutions
 - The Rise of Digital Reading Numerical Analysis Problems And Solutions
 - Advantages of eBooks Over Traditional Books
2. Identifying Numerical Analysis Problems And Solutions
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Numerical Analysis Problems And Solutions
 - User-Friendly Interface
4. Exploring eBook Recommendations from Numerical Analysis Problems And Solutions

- Personalized Recommendations
- Numerical Analysis Problems And Solutions User Reviews and Ratings
- Numerical Analysis Problems And Solutions and Bestseller Lists
- 5. Accessing Numerical Analysis Problems And Solutions Free and Paid eBooks
 - Numerical Analysis Problems And Solutions Public Domain eBooks
 - Numerical Analysis Problems And Solutions eBook Subscription Services
 - Numerical Analysis Problems And Solutions Budget-Friendly Options
- 6. Navigating Numerical Analysis Problems And Solutions eBook Formats
 - ePub, PDF, MOBI, and More
 - Numerical Analysis Problems And Solutions Compatibility with Devices
 - Numerical Analysis Problems And Solutions Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Numerical Analysis Problems And Solutions
 - Highlighting and Note-Taking Numerical Analysis Problems And Solutions
 - Interactive Elements Numerical Analysis Problems And Solutions
- 8. Staying Engaged with Numerical Analysis Problems And Solutions
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Numerical Analysis Problems And Solutions
- 9. Balancing eBooks and Physical Books Numerical Analysis Problems And Solutions
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Numerical Analysis Problems And Solutions
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Numerical Analysis Problems And Solutions
 - Setting Reading Goals Numerical Analysis Problems And Solutions
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Numerical Analysis Problems And Solutions

- Fact-Checking eBook Content of Numerical Analysis Problems And Solutions
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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