Eco Industry
Oriented University

sinarmas

FUNDAMENTALS OF APPLIED MATHEMATICS

Concepts and Applications in Mining

Written by:

Bakti Siregar, M.Sc., CDS.

D'SCIENCELABS
Smart Idea

Kampus Merdeka
INDONESIA JAYA

First Edition

Fundamentals of Applied Mathematics

Concepts and Applications in Mining

Bakti Siregar, M.Sc., CDS.

Table of contents

In today's mining industry, applied mathematics is essential for planning, modeling, and optimizing mining operations. From estimating mineral reserves and designing mines to processing ore, mining engineers and professionals rely on strong mathematical foundations to make informed, efficient, and safe decisions. By mastering the fundamentals of applied mathematics along with computational techniques, students and practitioners can analyze complex mining data, solve engineering problems, and develop robust mathematical models that drive innovation and operational excellence.

This book provides a comprehensive introduction to key concepts in applied mathematics and computational techniques tailored for mining applications. Topics covered include real numbers, functions, derivatives, integrals, and transcendental functions, alongside practical numerical methods for solving engineering problems in mining. Readers will gain hands-on experience in processing mining data, generating insightful visualizations, and applying mathematical techniques for process optimization, reserve planning, and risk assessment.

Furthermore, the book addresses data preprocessing, transformation, and integration, which are critical steps in preparing technical mining data for accurate analysis. Students will also develop practical skills in debugging, testing, and optimizing computational models, thereby enhancing the efficiency, reliability, and precision of mathematical solutions applied to real-world mining projects.

Preface

About the Writer

Bakti Siregar, M.Sc., CDSS works as a Lecturer at the ITSB Data Science Program. He earned his Master's degree from the Department of Applied Mathematics at National Sun Yat Sen University, Taiwan. In addition to teaching, Bakti also works as a Freelance Data Scientist for leading companies such as JNE, Samora Group, Pertamina, and PT. Green City Traffic.

He has a strong enthusiasm for projects (and teaching) in the fields of Big Data Analytics, Machine Learning, Optimization, and Time Series Analysis, particularly in finance and investment. His core expertise lies in statistical programming languages such as R Studio and Python. He is also experienced in implementing database systems like MySQL/NoSQL for data management and is proficient in using Big Data tools such as Spark and Hadoop.

Some of his projects can be viewed here: Rpubs, Github, Website, and Kaggle

---

Acknowledgments

Applied Mathematics plays a vital role in modeling, analyzing, and optimizing processes within the mining industry and broader engineering fields. This module introduces essential techniques in applied mathematics, including:

- A solid foundation in real numbers, functions, and calculus
- The ability to analyze and interpret mining and engineering data effectively
- A clear understanding of the role of mathematics in modeling and problem-solving
- Practical skills in applying derivatives, integrals, and numerical methods to real-world mining challenges

This book is designed for beginners who wish to build a strong foundation in Applied Mathematics while appreciating its concepts and applications in mining and engineering disciplines. We sincerely value the active participation of readers, whose insights and questions enrich the learning journey. We hope this material serves as a practical guide for applying applied mathematics to mining and engineering projects.

Feedback & Suggestions

Your input is invaluable in **improving this module**. We invite all readers to share their thoughts on the **content, structure, and clarity of the material**. Suggestions for additional topics or sections that need further explanation are highly appreciated.

With your support and contributions, we aim to make this e-book a **comprehensive resource for Data Science Programming and Applied Mathematics**. Thank you for your participation and feedback!

For feedback and suggestions, please contact:

Feedback & Suggestions

Your feedback is essential for improving the clarity, depth, and usefulness of this module. We encourage readers to share their thoughts on the content, structure, and explanations, as well as suggestions for additional examples, problem sets, or applications.

This input will help us refine the E-book into a more practical and comprehensive resource on Fundamental Mathematics, covering key topics such as Real Numbers, Functions, Derivatives, Integrals, and Transcendental Functions. Our goal is to bridge theoretical understanding with problem-solving skills relevant to both academic study and engineering practice. Thank you for contributing to the continuous development of this material! For feedback and suggestions, please contact:

- siregarbakti@gmail.com

- siregarbakti@itsb.ac.id
- dsciencelabs@outlook.com

Chapter 1

Introduction

Chapter 2

Real Numbers

Chapter 3

Essencials of Functions

Chapter 4

Special Functions

Chapter 5

Limits of Functions

Chapter 6

Basic Derivatives

Chapter 7

Appllied of Derivatives

Chapter 8

Indefinite Integrals

Chapter 9

Appllied of Integrals

Chapter 10

Transcendental Functions