



# Introduction to Numerical Computing

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### Abstract

The main aim of this paper is to understand the information to numerical computing. In this paper we solve some examples of numerical computing. The numerical computational techniques are the technique by which mathematical problems are formulated and they can be solved with arithmetic operations. Those techniques are basically numerical methods. Numerical method supports the solution of almost every type of problem. The numerical methods are classified depending upon the type of the problem.

**Keywords:** Numerical computing; Roots of equation

## Introduction to Numerical Computing

Numerical computing is an approach for solving complex mathematical problems using only simple arithmetic operations [1]. The approach involves formulation of mathematical models physical situations that can be solved with arithmetic operations [2]. It requires development, analysis and use of algorithms. Numerical computations invariably involve a large number of arithmetic calculations and, therefore, require fast and efficient computing devices [3]. The microelectronic revolution and the subsequent development of high, low cost personal computers have had a profound impact on the application of numerical computing methods to solve scientific problems [4].

## Numerical Methods are Classified Basically Depending upon the Type of Problem

### Numerical methods to find roots of equations

In many Engineering and Science application we come across some algebraic and transcendental equation [5].

Ex. Consider the equation:

$$F(x) = x^2 - 3x + 2$$

Such equation is satisfied at some specific value of x. These values are called roots of the equation. The solution of this equation can be obtained with the help of numerical methods [6].

### System of Linear Algebraic Equation

Consider,

$$2x + 3y = 7$$

$$5x + 8y = 18.$$

The values of x and y in these equation can be obtained with help of numerical method [7].

Direct method become complex for no. of variables.

Numerical method are the best solution for large system. Such equation are generated in analysis of electronic kits. Large structures etc. [8].

### Floating Point Numbers

The term floating point is derived from fact that there is fixed no of digit before and after the decimal point i.e., the decimal point can float [9].

There are also representation in which number of digit before and after the decimal no is set called as fixed point representation [10].

In general, floating point representations are slower and less accurate. Than fixed point representation, but they can handled a large range of numbers [11].

## Distinguish Between Analog Computing and Digital Computing

### Analog computing

Analog refers to the principle of solving a problem by using a tool which operates in way analogues to the problem [12,13]. Many real life measurable quantities are analog in nature: time, temperature, pressure, and speed, for instance. The basic requirement in the application of analog computers is the writing down of differential equations describing the physical system of interest [14,15].

### Digital Computing

A digital computer is a computing device that operates on inputs which are discrete in nature [16,17]. The input data are numbers that may represents numeral, letters, or other special symbols. Digital computers are more accurate than analog computers. Digital computers are widely used for many different applications and are often called general purpose computer [18-20].

## Characteristics of Numerical Computing

1. **Accuracy:** Every method of numerical computing introduces errors. They may be either due to using an appropriate in pace of an exact mathematical procedure or due to inexact representation and manipulation of numbers in the computer. These errors affect the accuracy of the results.
2. **Efficiency:** One more consideration in choosing a numerical method for solution of a mathematical model is efficiency.

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# Numerical Mathematics And Computing Solution

**George Karniadakis, Robert M. Kirby**



## **Numerical Mathematics And Computing Solution:**

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addressed to senior undergraduate and graduate students with particular focus on degree courses in Engineering Mathematics Physics and Computer Sciences The attention which is paid to the applications and the related development of software makes it valuable also for researchers and users of scientific computing in a large variety of professional fields

Numerical Analysis David Ronald Kincaid, Elliott Ward Cheney, 2009 This book introduces students with diverse backgrounds to various types of mathematical analysis that are commonly needed in scientific computing The subject of numerical analysis is treated from a mathematical point of view offering a complete analysis of methods for scientific computing with appropriate motivations and careful proofs In an engaging and informal style the authors demonstrate that many computational procedures and intriguing questions of computer science arise from theorems and proofs Algorithms are presented in pseudocode so that students can immediately write computer programs in standard languages or use interactive mathematical software packages This book occasionally touches upon more advanced topics that are not usually contained in standard textbooks at this level

Mathematical Software John R. Rice, 2014-05-27 Mathematical Software deals with software designed for mathematical applications such as Fortran CADRE SQUARS and DESUB The distribution and sources of mathematical software are discussed along with number representation and significance monitoring User modifiable software and non standard arithmetic programs are also considered Comprised of nine chapters this volume begins with a historical background in the form of a chronological list of events that trace the development of computing in general and mathematical software in particular The next chapter examines where and how mathematical software is being created and how it is being disseminated to eventual consumers A number of important shortcomings are identified The future of mathematical software and the challenges facing mathematical software are then discussed Subsequent chapters focus on the point of view of people outside the professional community of mathematical software the monitoring of significance in computation and its relation to number representation libraries of mathematical software and the automation of numerical analysis Eleven algorithms for numerical quadrature are also compared This book should be of considerable interest to students and specialists in the fields of mathematics and computer science

*Parallel Scientific Computing in C++ and MPI* George Em Karniadakis, Robert M. Kirby II, 2003-06-16 Numerical algorithms modern programming techniques and parallel computing are often taught serially across different courses and different textbooks The need to integrate concepts and tools usually comes only in employment or in research after the courses are concluded forcing the student to synthesise what is perceived to be three independent subfields into one This book provides a seamless approach to stimulate the student simultaneously through the eyes of multiple disciplines leading to enhanced understanding of scientific computing as a whole The book includes both basic as well as advanced topics and places equal emphasis on the discretization of partial differential equations and on solvers Some of the advanced topics include wavelets high order methods non symmetric systems and parallelization of sparse systems The material covered is suited to students from engineering computer science physics and

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