INTRODUCTION TO NUMERICAL METHODS

COURSE OUTLINE

1. Solution to Algebraic and Transcondental equations by iterations

2. Finite Differences

3. Difference Equations

4. Interpolations

5. Splines

6. Numerical solutions of linear equations using iteration methods

7. Ill conditioning

8. Matrix Analysis

9. Methods of matrix inversion

10. Numerical evaluation

11. Numerical integration applied to the error function and eliptic integers.

MATERIALS TO USE

1. Shaum’s Outline of Numerical Analysis by Francis Scherd

2. Advanced Engr. Maths by KA stroud

3. Advanced Engr. Maths by Allan Jeffery.

Numerical methods are a collection of techniques used to solve problems mathematically when exact (analytical) solutions are difficult or impossible to obtain. These methods provide approximate solutions that are often good enough for practical purposes.

When solving in this course, learn to solve to 6dp

Given a table of values such that x: independent and y: dependent

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | x\_o | x\_1 | x\_2 | x\_3 | x\_4 |
| y | y\_o | y\_1 | y\_2 | y\_3 | y\_4 |

Satisfies the relationship y=f(x) where the explicit nature of f(x) is not known

Interpolation is a process through which values between intervals could be gotten

FORWARD DIFFERENCE

To get two successive values of the dependent variable

The first difference is the difference between two successive dependent variables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | y | {%DELTA} | {%DELTA}^2 | {%DELTA}^3 |
| x\_0 | y\_0 |  |  |  |
|  |  | Y\_1 - y\_0 |  |  |
| x\_1 | y\_1 |  | (y\_2-y\_1)-(y\_1-y\_0) |  |
|  |  | Y\_2 - y\_1 |  | Y\_3 – 3y\_2 + 3y\_1 - y\_0 |
| x\_2 | y\_2 |  |  |  |
|  |  | y\_3-y\_2 |  |  |
| x\_3 | y\_3 |  |  |  |
|  |  | Y\_4 - y\_3 |  |  |
| x\_4 | y\_4 |  |  |  |

NOTE

If x\_1 – x\_0 = x\_2 – x\_1 = x\_3 – x\_1: Equal intrvals – Newton’s forward difference, Newton’s backward difference

If x\_1 – x\_0 <> x\_2 – x\_1 <> x\_3 – x\_1: Unequal Interval

Langrage method

Newton’s Divided Method

Stirling method

NEWTON’S FORWARD DIFFERENCE METHOD

Considering the table of values shown

Examples

1. Find the cubic polynomial that takes up the following values

x = 0,1,2,3

y = 1,2,1,10

Hence, evaluate f(4)

2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 | 4 |
| y | 1 | 3 | 9 | - | 81 |

Find f(3)

3. Find sine(52) given the following table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| %theta | 45 | 50 | 55 | 60 |
| Sin{%theta} |  |  |  |  |

NEWTON’S BACKWARD

This is similar to the forward difference. However, instead of using the first value y\_o for calculation, we use the lase y\_n

Examples

1. A second degree polynomial passes through the points (1,-1), (2,-1), (3, 1), (4, 5). Find the polynomial using the Newton’s forward and backward difference method.

ASSIGNMENT

1. Given a table of values, prove newton’s forward difference formula

2. Prove newton’s backward difference formula

3. Given certain values of x and log\_10(x)

(300, 2.4771), (304, 2.4829), (305, 2.4845), (307, 2.4871), find {log\_10}{301}