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EVALUATION OF PARALLEL SIDES AND SIMPSON'S RULE FOR DISPARATE STATISTICS

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ABSTRACT:

Numerical integration involves a broad family of algorithms to calculate the numerical value of a definite integral. Since part of the integration cannot be solved analytically, numerical integration is the most popular way of obtaining the solution. Many different methods are applied and used in an attempt to solve numerical integration for an uneven data space. The trapezoidal and Simpson's rule are widely used to solve numerical integration problems. Our article focuses primarily on identifying the method that provides the most accurate result. To achieve accuracy we use some numerical examples and find their solutions. Then we compare them with the analytical result and calculate their corresponding error. The minimum error represents the best method. Numerical solutions agree well with the exact result and obtain greater precision in the solutions.

Keywords: Numerical Integration; Trapezoidal Rule; Simpson's Rule

1. INTRODUCTION:

Numerical integration is the approximate calculation of an integral using a numerical technique. The concept of numerical integration is very important in Mathematics. Numerical integration is a main tool used by engineers and scientists to obtain an approximate result of definite integrals that cannot be solved analytically. The initial value problem and the boundary value problems involving ordinary or partial differential equations can be solved by numerical integrations. Numerical solutions do not usually allow the determination of general physical laws and do not usually indicate the dependence of the desired variables on the various parameters of the problem. If it is a smooth function integrand over a defined interval, there are many numerical methods to approximate the integral for unequal data points. The question arises as to which numerical method gives a more accurate result. Here we apply a different numerical integration formula for unequal data space and determine the desired numerical method which tried to determine the numerical differentiation and integration error and also derived some formula for numerical differentiation through the divided difference and these new formulas they are quite useful for approximating derivatives when Additional information on derivatives in some developed a new approach to numerical integration schemes for unequal data spaces. He sped up Simpson's method of solving nonlinear equations. To this end, he represented an improvement on Simpson's classical third-order method for finding zeros of nonlinear equations and introduced a new formula to approximate the second-order derivative. Generalized Simpson, New Ton Method for Solving Nonlinear Equations with Cubic Convergence. For that, a new class of Newton's method is proposed to solve a single non-linear equation. Developed Simpson's method for solving nonlinear equations. He proposed the integration method to find the root of the nonlinear equation. The rest of the article is organized as follows. In Section Two, we presented the general quadrature formula for the uneven space. In section three, we discussed the trapezoidal and Simpson's rule for uneven space. In section four, we discuss some numerical examples. Finally, we draw a conclusion.

2. GENERAL QUADRATURE FORMULA FOR UNEQUAL SPACE

Consider a definite interval

$$\int_{x0}^{xn} ydx = y0(xn-x0)+(xn-x0)^2/2[x0,x1]$$

$$+1/2[(x0,x1,x2)][(xn-x0)(xn-x1)^2 - 1/3(xn-x2)^3+1/3(x0-x1)^3+\ldots \quad \text{----(Eqn 1)}$$

(A) Numerical Integration Methods

To By Eqn. (1), we can obtain different integration formulae for n=1, 2, 3...etc

(B) Trapezoidal Rule

For n=1 in eqn (1) then we get for the interval [x0, x1]

$$\int_{x0}^{xn} ydx=y0(x1-x0)+x1-x0)^2/2[x0,x1]=(x1-x0)/2[y0+y1]$$

Similarly, for intervals [x1, x2],[x2 ,x3]...[xn-p ,xn] we compute the integrals and adding all these terms.

$$\int_{x0}^{xn} ydx=1/2[(x1-x0)y0+(x2-x0)y1+(x3-x1)y2+\ldots+(xn-xn-2)yx-1+(xn-xm-1)ym]$$

(C) Simpson's Rule Formula

According to various sources, Simpson's rule can be used to approximate the integrals. This is done using quadratic polynomials. Here, the parabolic arcs are present in place of the straight line segments that were used in the trapezoidal ruler.

Simpson's one-third rule can give definitive results when it comes to finding approximate polynomials. This can be done up to cubic degrees. It is important to remember that the trapezoidal formula would help to take shape under a curve and find the area of those objects. However, if one wants to make those approximations better and more precise, then Simpson's formula is the way to go.

It should also be noted that the parabolas of Simpson's rule are used to find parts of a curve. This means that according to Simpson's meaning, the approximate area under the curve can be calculated by the following formula:

$$\int_{a}^{b} f(x)\, dx = h3\, (y0+yn)+4(y1+y3+\ldots..+yn-1)+2(y2+y4+\ldots.+yn-2)$$

This formula is also known as the simpson's 1 / 3 rule formula. Similarly, the simpson's 3 / 8 rule formula is mentioned below.

$$\int_{a}^{b} f(x)\, dx = 3h8\, (y0+yn)+(y1+y2+y4+\ldots+yn-1)+2(y3+y6+..+yn-3)$$

It is vital for our readers to note that the simpson's 1 / 3 formula and simpson's 3 / 8 rule formula is more accurate than any other methods of numerical approximations. The formula for n + 1 equally spaced subdivisions can also be given by the same method. However, in that case, n would be the even number, $\triangle x = (b - a) / n$ and $x_i = a + i\triangle x$

In this case, one must assume that we have f(x) = y. These are equally spaced between a,ba,b and if a = x0, x1 = x0 + h, x2 = x0 + 2h, ..., xn = x0 + nh. Here, h is the total difference between both the terms. We can also state that y0 = f(x0), y1 = f(x1), y2 = f(x2), …, yn = f(xn) are the analogous values of y with every value of x.

(D) Simpson's 1/ 3rd Rule

By now, readers should have understood an overview of the topic. Now, we will look at the different types of rules and the example of Simpson's 1/3 rule in more detail.

According to various sources, Simpson's 1/3 rule is an extension of the trapezoidal rule. For readers unfamiliar with the term, the trapezoidal rule is a numerical method in which the integrand is roughly calculated using a second-order polynomial.

These facts indicate that if one uses Newton's divided difference polynomial, method of coefficients, and Lagrange polynomial, then one can derive this rule.

Putting n=2 in eqn(1) then we get for the interval[x0,x2]

$\int_a^b ydx=y0(x2-x0)+(x2-x0)^2[x0,x1]+1/2[x0,x1,x2]((x2-x0)(x2-x1)^2 - 1/3(x2-x1)^3 +1/3(x0-x1)^3)$ Similarly, for intervals [x2,x4]…[xm-2,xn] we compute the integrals and adding all these terms. Then we got the following general formula of Simpson`s 1/3 rule for unequal space.

$\int_{x0}^{xn} ydx= \sum^n {}_{i+2}y+2(xi-xi+2)+(xi-xi-2)^2/2)[xi+2,xi+1]((xi-xi+2)(xi-xi+1)^2-1/3(xi-xi+1)^3)+1/3(xi+2-xi+1)^3)$----

(E) Simpsons 3/8 Rule

Putting n=2 in eqn(1) then we get for the interval[x0,x2]

$\int_{x0}^{xn} ydx=y0(y3-y0)+(x3-x0)^2/2[x0,x1]+1/2[x0,x1,x2]((x3-x0)(x3-x1)^2-1/3(x3-x1)^3+1/3(x0-x2)^3)+1/2[x0,x1,x2,x3]((x3-x0)(x3-x1)(x3-x2)^2-1/3(x3-x1)(x3-x2)^3-1/3(x0-x1)(x0-x2)^3)+1/12(x3-x2)^4-1/12(x0-x2)^4$

Similarly for intervals[x3,x6]---[xn-3,xn] we compute the integrals and adding all these terms. Then we got the following general formula of Simpson`s1/3 rule for unequal space.

$\int_{x0}^{xn} ydx= \sum^n {}_{i-3}y_{i-3}(xi-xi-3)+(xi-xi-3)^2/2[xi-3,xi-2]+1/2[xi-3,xi-2,xi-1]((xi-xi-3)(xi-xi-2)^2-1/3(xi-xi-2)^3+1/3(xi-3,xi-2)^3)+1/2[xi-3,xi-2,xi-1]((xi-xi-3)(xi-x-2)(xi-xi-1)^2-1/3(xi-xi-2)(xi-xi-1)^3+1/3(xi-3-xi-2)(xi-3-xi-1)^3)+1/12(xi-xi-1)^4-1/12(xi-3-xi-1)^4$

CONCLUSION

The main objective of our work is to determine a better numerical integration formula for unequal data spaces. Therefore, we apply the trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule to solve various number problems and compare the result with their exact solution. We have found that Simpson's 1/3 rule gives better results than any other numerical method for unequal data spaces.

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