Current applications of differentiation and differential equations research paper...

Education, Discipline

Abstract

The paper focuses on the current application of differentiation and differential equations. Differentiation involves evaluating derivatives, while differential equations are equations involving derivatives. Differentiation is useful in optimization of production; cost minimization and profit maximization. This is a direct and practical application in the discipline of management accounting. Moreover, differential equations are useful in modeling natural phenomena, and solving complex problems in physics, such as electromagnetic waves, RLC circuits, population growth, and chemical reactions problems. In addition, electrical apparatus problems, such as the Ohmic heating problem of a thermistor, are modeled using differential equations.

Current Applications of Differentiation and differential equations

Differentiation is a process of finding derivatives of functions. The derivative of a function gives a measure of how the dependent variable changes with the independent variable. Also, the derivative of a function at a given point is equivalent to the slope of the function at that point. In addition, derivative of a function is also the limiting value of the function as the independent variable approaches zero. Equations involving derivatives are known as differential equations. Differentiation and differential equations have wide application in many disciplines such as physics, economics, and engineering among others. The paper discusses current application of differentiation and differential equations in various aspects and disciplines. Differentiation is useful in optimization of production; cost minimization and profit maximization. Moreover, differential equations are useful in modeling natural phenomena and solving complex problems. In addition, electrical apparatus problems, such as the Ohmic heating problem of a thermistor, are modeled using differential equations.

Optimization of production

The concept of differentiation is used in evaluating minimum and maximum points in several disciplines. Firstly, it provides an efficient and easy way of evaluating maximum profits and minimum cost. This process is known as optimization. To find the financial solution, cost and profit functions are differentiated and equated to zero. For example, if the total cost function of a company is defined by the formulae T(c) = 2q2 - 800q + 100, where q is the quantity produced in thousands, the minimum cost can be calculated by finding the optimal production quantity q by differentiation the cost function. In this case, the derivative = 4q -800. Equating this value to zero, we obtain = 4q- 800 = 0. Therefore, 4q -800= 0, and q = 200. Therefore, the optimal production quantity for minimum cost is 200, 000 units (Dwivedi, 2006). Engineers use derivatives to estimate the amount of materials required for construction. In this regard, the area of the surface is proportional to the amount of material required, and the minimum material required is obtained by differentiating the function as shown above. Moreover, the concept of partial derivatives is used to find solutions for constrained variables. This happens for cases where the dependent variable is defined by more than one variable (Dwivedi, 2006).

Modelling.

Differential equations are useful in modeling rates of flow in many plants, such as water processing plants. Also, they are used in modeling chemical equations, population growth, and radioactive decay problems. For example, if the rate conversion of substance M to substance N is proportional to the square root of the substance M. In this case, letting the unconverted amount of substance M be equal to Z at time t, then the reaction is modeled by the differential equation = kZ1/2, where K is a constant. This is equation is solved when the initial and the boundary conditions are know. Therefore, gives a model equation for evaluating the amount of substance remaining at any instance. This concept is used to project future population sizes. Also, it is used to estimate the time for which nuclear wastes would have an impact on a population (Blanchard, Devaney, & Hall, 2006).

Electromagnetic waves are widely used in modern technology, such as in radio and microwave transmission. The energy E and magnetic flux density B of the electromagnetic wave is modeled by the equation below.

)2 E= 0,

)2B = 0, these equations are solved to find the wave length of transmission and the wave number (Blanchard, Devaney, & Hall, 2006). This model is widely used in the design of transmitters to ensure desired wave lengths are transmitted.

Solving complex problems

Differential equations are essential in solving complex problems in quantum mechanics, fluid mechanics, electricity, and solids elastic problems. For example, the Schrödinger, Laplace, and Navier-stokes equations are set of differential equations that help in solving real problems in these areas. For example, solving RL circuit requires the application of differential equations. This forms the beginning of the solution as shown below.

L + Ri = E, this is the differential equation that forms the solution to the problem. Solving this differential equation results to: i=). This equation helps in determining the amount of currents through resistive components connected in series with inductive components. In addition, differential equations are use in the time domain analysis of voltages in RLC circuits (Blanchard, Devaney, & Hall, 2006).

Electrical Appliances

Lastly, differential equations find practical application in electrical appliances, such as a thermistor. A thermistor is a temperature register. The Ohmic-heating problem is described by the equations:

Q(u) }2 + (K(u). –u(t) = 0

And (= 0 (

Where U= temperature due to electric current, Q = electric potential, , and K(u) = thermal conductivity (Hachimi & Amni, 2004). These equation models the basic principles of operation of a thermistor.

In conclusion, the application of differentiation and differential equations is useful modeling natural phenomena and solving complex problems. However, the application of differential equations in these areas is not independent and must be integrated with other concepts and principles.

References

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