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APPLICATION OF DIFFERENTIAL EQUATION IN ADVANCE ENGINEERING MATHEMATICS

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ABSTRACT

Advanced engineering mathematics give us comprehensive mathematical ideas, techniques and their applications for computer science, physical science, etc. The introduction of each new idea and the large problem of sets provide many greater challenges and insight for students.
While some a major part of the methods is only benefits for academic purposes, there are some which are useful in the solutions of real problems comes from science and engineering mathematics.
Here we discuss only limited methods for solving ordinary and partial differential equations.

Keywords: *First order and first degree, Basic Derivatives, existence and uniqueness.*

1. INTRODUCTION

Differential equations are useful in engineering mathematics because many of the physical laws, biological relations, etc... Appear mathematically in the form of differential equations. We shall consider various geometric problems that solve to differential equations, we shall explain some important standard methods for solving engineering problems.

Here we have to formulate the engineering problems as a mathematical expression is known as mathematical model of the given engineering problems.

Mathematical modelling is being recognized within every field of science as an important technique that can aid the understanding of systems.

Since many physical concepts, just like as velocity and acceleration etc…, a mathematical model is very useful an equation containing derivatives of an unknown function. Such a model is called a differential equation.

Many engineering problems and phenomena in nature can be described by differential equations.

To understand the problem of engineering and nature, we have to do this –

1. Drive the differential equation from those engineering or nature problems threw modelling,

2. Solve the equations by using standard methods',

3. Find the solutions of that problem.

At last, we can see that what will happen.

2. FIRST –ORDER ORDINARY DIFFERENTIAL EQUATIONS

2.1 BASIC MATHEMATICAL MODELING

A problem is formulated by some variables, equations and functions is kown as **MATHEMATICAL MODELING**.

To solve the problems, first we have to convert over problem in mathematical equations. If we have any physical problem then we have to formulate them as mathematical expression in terms of physical parameters.

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A ORDINARY DIFFERENTIAL EQUATION is a collection of dependent variables, independent variables and derivative of dependent variables with respect to independent variables (i.e., the equations that contains one or several derivatives of an unknown functions), which we usually sometimes y(t) if the independent variable is t. the equation may contain y, known functions of x(or t) . And constants

For Examples,

1. $Y^1 = 4COS\ X$,

2. $Y^{11} + 19Y=0$,

Are examples of the ordinary differential equations (ODEs).

An ordinary differential equation known as a differential equation of order n if the nth derivative of an unknown function y is the highest derivative of y in the differential equation. The concept of order gives a fruitful classification into ODEs of first order, second order, third order ………and so on.

Here we shall consider first –order ODEs. Such equations contain only the first partial derivatives $y^1(x)$ and many contain y and any given functions of x. Hence we can write them as

$$F(x, y, y1) = 0$$

Or often in the form $y^1 = f(x, y)$

This is called the explicit form, in contrast with the implicit form. the implicit ordinary differential equation $X^{-3}Y^1 - 8\ Y^2 = 0$ (where $x \neq 0$) can be written explicitly as $y^1 = 8x^3y^2$.

ORDER & DEGREE OF ODE :- It is the highest derivatives in the equation is the order of the differential equation and the power of highest order derivatives is called the degree of the differential equation , where all the dependent variables and its derivatives are free from radical signs .

$X^{-3}Y^1 - 8\ Y^2 = 0$ (where $x \neq 0$) ; this is the differential equation of order one and degree one .

LINEAR & NON LINEAR DIFFERENTIAL EQUATION: - If the power of dependent variables and its derivatives are one , is known as linear , otherwise nonlinear.

For examples

1. $y^{11} + 8y = e^x logx$; linear differential equation

1 . $y^{2.5} + y^{.5} - 9y = sinx + 3$; Non-linear differential equation

REAL LIFE EXAMPLES OF ORDINARY DIFFERENTIAL EQUATIONS IN VARIOUS FIELDS

Differential equations have a memorable ability to observe the world around us. They are used in various fields, just like as, variety of displines, from economics, chemistry, physics, biology and engineering. They all can give the detail of exponential growth and decay, the change in investment return over time. One of the examples of differential equations is the Malthusian Law of population growth.

$dp/dt = rp$, represent the population (p) changes with respect to time . The constant r will change depending on the species. Mathura's used this law to predict how a spice would grow over time.

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Some other uses of ordinary differential equations include:

1. In medicine for modelling cancer growth of disease.
2. In engineering for representing the moment of electricity.
3. In chemistry for modelling chemical reactions and to computer radioactive half-life.
4. In economics to find some optimum investment strategies.
5. In physics to describe the motion of waves, pendulums or chaotic systems. It is also used in physics with Newton's Second Law of Motion and the Law of Cooling.
6. In Hooke's law for modelling the motion of a spring for population growth and money flow.

As we can see from the above examples, unless you are a physicist or a chemist or a biologist or an actuary or an electrical/electronics engineer, chances are that you might not get a chance to use differential equations.

3. CONCLUSION

Differential equations are a very large field of study. Differential equations allows the area to be applied to a different different of topics from physics to population growth and decay to the stock market. They are a useful technique for modelling and studying naturally occurring phenomena such as calculating when beams may break as well as predicting future outcomes such as the spread of disease or the changes in populations of different species over time. Anytime an unknown phenomena is changing with respect to time, a differential equation is include.

REFERENCE

1) IB maths resources from British international school Phuket

2) ERWIN KREYSZIG (Advance engineering mathematics ,10th edition)
For further details see, for example, D. Halliday, R. Resnick, and J. Walker, Fundamentals of Physics. 9th ed., Hoboken, N. J: Wiley, 2011. See also AN American National Standard, ASTM/IEEE Standard Metric Practice, Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Lane, Piscataway, N. J. 08854, website at www.ieee.org.