

A Survey on Mathematical Applications in Engineering

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Abstract - All engineering makes considerable use of mathematics. This paper will look at some examples of math applications in various engineering fields. The applications are those that can be found in real life, such as in the manufacturing industry, where many mechanical engineers work. While engineering mathematics is a required course in mechanical engineering departments, few students are proficient in it. Many engineering mathematics textbooks do not adequately cover real-world applications; even many engineering mathematics textbooks do not adequately cover real-world applications. Most pupils who have studied mathematics extensively are unable to relate mathematics to other topics that contain a significant amount of maths. It is hoped that this will be the case.

Key Words: Algebra, Binary, Calculus, Discrete, Statics

1. INTRODUCTION

Engineering professions has a number of subjects that contain a significant amount of mathematics, which should be referred to as engineering mathematics. Materials Mechanics, Thermodynamics, Heat Transfer, and Internal Combustion Engines are some of the topics covered. Despite the fact that many students have studied engineering mathematics; the majority of them are unable to link it to engineering disciplines. They should be able to solve deflection issues in mechanics of materials, for example, after studying differential equations in calculus. Mathematics or particularly applied mathematics is widely used in every engineering fields.

Probability and Statistics applied in Calculation of insurance risks and price of insurance, Analysis of statistical data taken by a census, Reliability and uncertainty of large scale physical simulations, Speech recognition, Signal processing, Computer network design, Tracking and searching for submarines, Estimation of ocean currents, Paint stripping using lasers Onset and progression of cancer and pre-malignant cells, Determining launch schedules to establish and maintain prescribed satellite constellations, Radar track

initiation, Aircraft survivability and effectiveness, Color sample acceptance tolerance correlation and prediction, Determination of sample sizes for color acceptability, valuation, Underwater acoustic signal processing, Reliability analysis of complex systems, Radio interferometry.

Numerical Analysis applied in Estimation of ocean currents, Modeling combustion flow in a coal power plant, Airflow patterns in the respiratory tract, Regional uptake of inhaled materials by respiratory tract, Transport and disposition of chemicals through the body, Molecular and cellular mechanisms of toxicity, Reentry simulations for the Space Shuttle, Trajectory prescribed path control and optimal control problems, Shuttle/tank separation, Scientific programming, Modeling of airflow over airplane bodies, Electromagnetics analysis for detection by radar, Design and analysis of control systems for aircraft, Electromagnetics, Large scale shock wave physics code development, Curve fitting of tabular data.

2. COMPUTER SCIENCE

1. Binary Math

Binary math is the heart of computer operation and among the most essential types of math used in computer science. Binary is used to symbolize every number within the computer. The binary number system is an alternative to the decimal system. Using this system simplifies computer design. Reading and simple mathematical operations are vital for hardware low-level programming. Knowing how to work with a hexadecimal number system is necessary for various programming functions, including setting the color of an item. Standard arithmetic is utilized in numerous functions of computer programming. In nearly every written

program, addition, subtraction, multiplication, and division area used.

2. Algebra

College algebra covers various concepts, including linear equations, operations, factoring, exponents, polynomials, quadratic equations, rational expressions, radicals, ratios, proportions, and rectangular coordinates. It focuses on

algebraic relationships, graphs, and functions and students learn to solve for one or two unknown variables in various complex equations. Students also learn how to graph algebraic functions. Algebra is used in computer science in the development of algorithms and software for working with mathematical objects. It is also used to design formulas that are used in numerical programs and for complete scientific computations. Algebra applied in Computer Science such as Cryptology, Scheduling tasks on processors in a heterogeneous multiprocessor computing network, Alteration of pattern pieces for precise seam alignment, Study of crystal symmetry in Chemistry.

3. Statistics

Statistics is a form of math used in computer science that uses quantified models, representations, and synopses for a provided collection of experimental data or actual studies. The field studies methodologies to obtain, review, evaluate, and form conclusions from data. Some statistical measures include mean, skewness, regression analysis, variance, analysis of variance, and kurtosis. Statistics plays a fundamental part in computer science as it is used for data mining, speech recognition, vision and image analysis, data compression, traffic modeling, and even artificial intelligence, as shared by Medium. It is also used for simulations. A background in statistics is needed to understand algorithms and statistical properties of computer science.

4. Calculus

Calculus is the examination of continuous change and the rates change occurs. It handles the finding and properties of integrals and derivatives of functions. There are two types of calculus, differential calculus, and integral calculus. Differential calculus deals with the rate of change of a quantity. Integral calculus determines the quantity where the change rate is known. Calculus is used in an array of computer science areas, including creating graphs or visuals, simulations, problem-solving applications, coding in applications, creating statistic solvers, and the design and analysis of algorithms. Calculus is a branch of mathematics that concerning rates of change and accumulation. The majority electrical and electronic engineering programs need calculus. Calculus is a requirement for the majority.

5. Discrete Math

Discrete math examines objects that can be represented finitely. It includes a variety of topics that can be used to answer various tangible inquiries. It involves several concepts, including logic, number theory, counting, probability, graph theory, and recurrences. Discrete math provides an important foundation for all areas of computer science. Discrete math is used in various areas including computer architecture, algorithms, computer systems, databases, functional programming, distributed systems,

machine learning, operating systems, computer security, and networks. The problem-solving methods taught in discrete math are needed for composing complicated software.

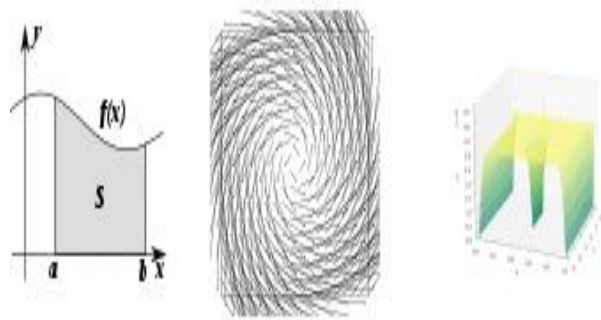


Figure 1:- Calculus

2. ELECTRICAL AND ELECTRONIC ENGINEERING

Engineering especially in Electrical engineering is nothing without math. The knowledge of Calculus is most important in Electrical engineering field. From circuit theory to control systems, from thermodynamics to microprocessors, digital signal processing, linear control system, high voltage engineering, robotics, micro controller with program and illumination, solar, energy structures, communication all are based on this pillar. In the field of voltage generator, computation of current, power, efficiency, RLC circuits and other useful quantities are relies heavily on the knowledge of trigonometric identities. Linear algebra is widely used in digital signal processing, communication systems, error control coding, circuit analysis, robotics circuits and power systems. Ordinary, linear, non-linear, partial all these differential equations are plays a very important role in electrical engineering, such as in basic electric machines, power systems, antennas, optics and it is also in image processing. Fourier Transforms come into play and help us with our signal processing, heat transfer, power systems and control system. In electromagnetism we use the knowledge of Vector Algebra. If we want to find the probability of signals and events in telecommunication systems and random events then we must have learned about Probability and Statistics. To understand the geometrical structures in complex form, electronics and quantum field theory, moreover in designing power systems of planning control Electrical and electronic engineering courses. It consist • Derivatives and integrals of functions in one dimension. These groups additionally cover themes like speed. • Calculus requires in an electrical and electronic engineering program contact with functions in two and three d measurements and takes in issue like surface and volume integrals, and partial derivatives. Calculus is likewise really valuable. Some basic conditions are basically derivations of others with a touch of differentiation or integration tossed in [5] For real example Current i Amps am the rate of change of charge q Coulombs. That is Current, $I = dq/dt$. Current i Amps flowing in a

capacitor is the capacitance C farads times, the rate of change of voltage v Volts across the capacitor. That is: Current, $I = C dv/dt$. Voltage v Volts across an inductor is the inductance L henrys times the rate of change of current i Amps flowing in the inductor; Voltage $v = L di/dt$ [6] Utilizes of integration in electrical and electronic engineering to decide the correct length of intensity link expected to associate two substations that are miles separated. Since the link is swung from posts, it is always bending. Calculus enables an exact figure to be resolved.

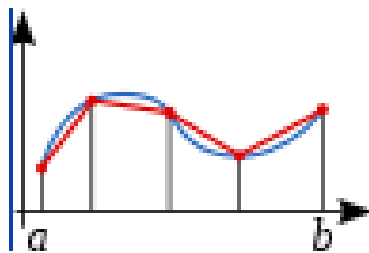


Figure 2:- Statistics

Probability and statistics

The key mastery in designing is evaluating and researching peril and a decent number of electrical and electronics engineering programs require understudies take courses in probability and statistics to develop the aptitudes and figuring out how to gauge danger and prosperity in their plans. Courses in measurements cover focuses like frequency understanding of probability, probability theory, discrete probability and combinatorics, distribution and density capacities, and sampling theory. These courses also start the utilization of probability and Statistical models to discover the execution of Success or disappointment of understudy system . Probability theory gives ground-breaking apparatuses to clarify, model, analyze, and design technology created by electrical and electronics engineering. From the field of correspondence building, advanced correspondence, Filter outline for clamor retraction, design acknowledgment if there should be an occurrence of Radar are for the most part display by Probability, stochastic process and insights.

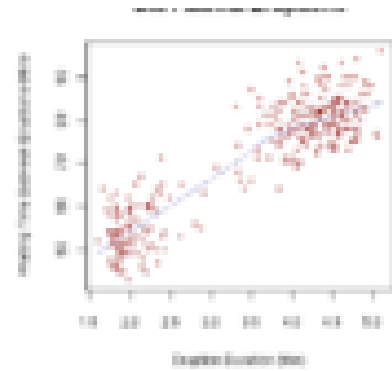


Figure 3:- Statistics

3. MECHANICAL ENGINEERING

Co-ordinate Geometry

Geometry plays an important role in electrical engineering. Geometry is used in designing power systems, in planning control and flight systems. Computational geometry is used in design and manufacture electrical circuit. Also algebraic geometry is used to solve implicitization and inversion problems [7] 3.3. Vector analysis In Vector analysis, there has a fundamental bit of electromagnetism. Students ought to have the capacity to recognize areas in which the extents of the difference or twist will be substantial or little. To help calculated understanding, graphical elucidation, and verbal depiction it is useful to associate students of vector analytics with applications [8]. For example, electromagnetic fields, liquid mechanics and warmth exchange. In electromagnetism student find out about Stokes and Divergence theorems and how they are utilized as a part of depicting basics of electricity produced via friction [9]

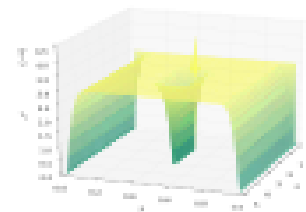


Figure 4:-Differential Equations

Kinematics

Kinematics can be defined as the study of motion without regard to forces [10]. Kinematics has many applications such as in bicycles, automobiles, tractors and cranes. Thermodynamics is a very important subject which has many applications in industry and our everyday life.

Here we will show where a lot of mathematics is needed in the Equation of State (EOS) which is a part of thermodynamics. Students without enough background in mathematics will be very difficult to understand it.

Mechanics of Materials

There are many applications of the subject such as in buildings and structures of cars and heavy equipment. An example of the application is in the determination of the deflection when a beam is given a partial triangle load. We will find the curve of deflection along the beam and determine the maximum deflection that occurs. The relationships between the bending moment M_x for

Operations Research

Operations Research and Optimization applied in Network formulation of cut order planning problem, Shade sorting of colored samples to an acceptable tolerance by hierarchical clustering, Inventory control for factory parts, Search for and tracking of submarines, Motion of a space vehicle, Aircraft survivability and effectiveness, Interplanetary mission analysis, Radio interferometry, Scheduling tasks on processors in a heterogeneous multiprocessor computing network, Microwave measurements analysis, Coordinate measuring machine, Optics for design of a reflector, Materials science, Reliability and uncertainty of large scale physical simulations.

IV. CONCLUSION

Engineering has many subjects with a lot of mathematics content in them. However, many students cannot relate mathematics to those subjects. Many examples of engineering applications can be found in the textbooks but they are often differently applied in mechanical engineering. Examples of applications of engineering mathematics in this paper are important in the industry. Hopefully, real problems taken from engineering subjects will encourage students to study engineering mathematics better.

REFERENCES

- [1] D. Kornack and P. Rakic, "Cell Proliferation without Neurogenesis in Adult Primate Neocortex," *Science*, vol. 294, Dec. 2001, pp. 2127-2130, doi:10.1126/science.1065467.
- [2] M. Young, *The Technical Writer's Handbook*. Mill Valley, CA: University Science, 1989.
- [3] R. Nicole, "Title of paper with only first word capitalized," *J. Name Stand. Abbrev.*, in press.
- [4] K. Elissa, "Title of paper if known," unpublished.
- [5] Duffy, D.G., *Advanced Engineering Mathematics*. Boca Raton: CRC Press, 1998.
- [6] James, G., *Advanced Modern Engineering Mathematics*, Fourth Edition. Essex: Pearson Educational Ltd., 2011
- [7] Kelly, S.G., *Advanced Engineering Mathematics with Modelling Applications*. Boca Raton: CRC Press, 2009.
- [8] Kreyzig, E., *Advanced Engineering Mathematics*, Tenth Edition.