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How Apply Mathematics in Engineering Fields

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ABSTRACT

Mathematics or particularly applied mathematics is widely used in every engineering fields. In this paper, several examples of applications of mathematics in civil, mechanical, electrical and architectural engineering are discussed. The role of mathematics in engineering education is one of these opportunities. There has been much recent debate on what mathematical skills are needed for the engineers of tomorrow, and how and when these might best be acquired. We conclude that the value of mathematics in engineering remains a central problem, and argue that mathematics should be a fundamental concern in the design and practice of engineering.

KEYWORDS: *civil; mechanical; electrical; architectural*

1. INTRODUCTION

There is a widely understood need for professional engineers and student 'becoming engineers' to think mathematically and to use mathematics to describe and analyse different aspects of the real world they seek to engineer. In civil engineering there is several applications of mathematics tools to simplify various problems like finite element analysis of structure, particle study in liquid, air and in solid state, Determination of various Sectional properties etc. The core Mechanical Engineering subjects will use math consisting of Calculus, Matrices, Statistics and so on. A mathematical thinking is a vital skill needed in electrical engineering.

Electrical engineering is based on deep know-how over the science and mathematical thinking. Mathematics, a technical science, plays an integral role in architectural design. The use of mathematics is applied both artistically and practically in creating a design solution. Also in determining of various properties like area, volume, centroid, moment of inertia, radius of gyration, slenderness ratio etc. of different sections like rectangle, triangle, circle and compound section mathematics had played vital role.

2. Some of the mathematics Tools

A. Trigonometry
B. Calculus
C. Differential Equation
D. Probability and statistics

2.1. How Mathematics uses in Civil Engineering

Civil engineering coursework involves the application of mathematical principles and skills to real world problems. Classes such as Structural analysis examine structures like trusses, beams and frames, and Concepts like Virtual work, energy methods and influence lines. Mechanics of solids includes topics like internal forces and deformation in solids, stresses and deflections in beams, and column theory and analysis.

A. Trigonometry

- Civil engineers use trigonometry to calculate angles and elevation when a building is to be plan.
- Civil engineers use Trigonometry often when
- surveying a structure. Surveying deals with land elevations as well as the various angles of structures.

B. Calculus

- Calculus is the study of the rate of change in functions. Most civil engineering programs require calculus.

C. Differential Equations

- Differential equations, is a more advanced mathematics course required by some civil engineering programs. It includes topics like first-order differential equations, undetermined coefficients and systems of linear differential equations, with a focus on applications to science and engineering.

D. Probability and statistics

- Most civil engineering programs require students take courses in probability and statistics to develop the skills and knowledge to quantify risk and safety in their designs.
- Courses in statistics cover topics like frequency interpretation of probability, probability theory, discrete probability and combinatory, distribution and density functions, and sampling theory.

2.2. How Mathematics uses in Mechanical Engineering

A mechanical engineer uses his skills to design, develop and repair mechanical equipment, tools and machinery. Mechanical engineers combine math with analytical and problem-solving abilities to develop or repair new equipment and machines. In the auto industry, an engineer might design a new chassis, for instance. This process usually involves analysis of current parts, awareness of desired goals and performance standards, and use of both math and creativity to design a better part that fits within

the construct of the car's engine. Basic math calculus and trigonometry are especially important math skills for a mechanical engineer.

A. Trigonometry

- Mechanical engineers use trigonometry when calculating extremely large and miniscule distances where it would be impractical to use physical methods using measuring devices to measure the distances.

B. Calculus

- Almost all areas for theory part and very much used in Fluid Mechanics and Thermodynamics.
- Vibrational mechanics: calculus for finding out the velocity and acceleration of the vibrating object.

C. Differential Equations

- Mechanical engineers use Differential Equations
- such as Heat Transfer, Fluid Dynamics, Mechanical Vibrations

D. Probability and statistics

- Mechanical engineers will use probability following statistical testing of components until failure
- One of the applications of statistics is in Tolerance analysis

2.3. How Mathematics uses in Electrical Engineering

The learning materials used in learning engineering should be based on companies' real-life problems, which require mathematical logic skills to be solved. Thus, these materials can easily also be used in the training of professionals in work life. This, together with the engineering students who will graduate with better mathematical logic skills and be the future work force in enterprises, will contribute to the higher performance of the European enterprises.

A. Trigonometry

- Trigonometry is the science of measuring triangles.
- Engineers may use plane trigonometry to determine the size of an irregularly shaped parcel of land.

B. Calculus

- Calculus is used by engineers to determine rates of change or rates by which factors, such as acceleration or weight, change.
- It might tell NASA scientists at what point the change in a satellite's orbit will cause the satellite to strike an object in space.

C. Differential Equations

- Ordinary, linear, non-linear, partial differential equations are very important in electrical engineering, whether it be circuits or it be control systems or communication, electromagnetics it plays a huge role in it, it is also used in image processing and other allied parts.

D. Probability and statistics

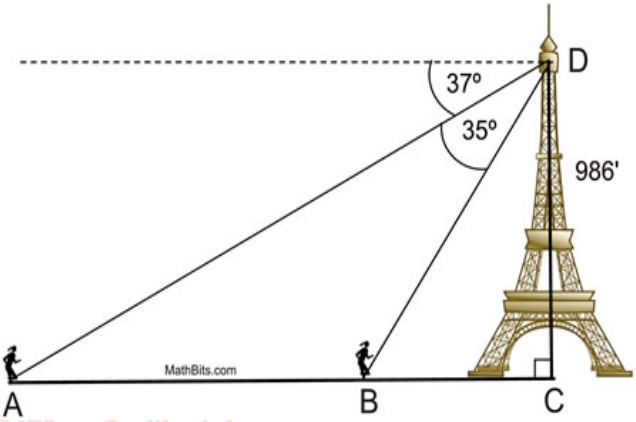
- Probability and statistics are used Communication systems, Signal Processing, Network Analysis.

2.4. How Mathematics uses in Architect Engineering

Ancient architects had to be mathematicians because architecture was part of mathematics. Mathematics is one component of the architectural design process that remains behind the scenes. The architectural space is based on a geometric space concept. In the history, architects were mathematicians and also some mathematicians were architect too. Vitruvius was a very well-known architect as well as famous mathematician. Mathematical readings of Pythagoras were later used in building proportions. Well known worker and user of golden ratio Leonardo Da Vinci along with many achievements was an architect too. The approach of this research paper is to come up with findings on importance of mathematics in architecture, as in geometry, from very important site analysis to final design of elevation or façade. Aim of the whole research is to come up with mathematical functions related to mensuration of building construction and Architectural Engineering.

A. Trigonometry

- Using math and design principles, they built pyramids and other structures that stand today. Because angles are an intricate part of nature, sines, cosines and tangents are a few of the trigonometry functions ancient and modern architects use in their work.



Eiffel Tower

B. Calculus

- Architecture blends several subjects together, including calculus. Since calculus is used for examining forces over time, it is the main reason buildings don't topple over in hurricanes and heating systems don't overload in the winter.

C. Differential Equations

- A degree in architectural engineering is essentially a civil engineering degree with some architecture and other engineering coursework mixed in and it requires calculus and differential equations.

D. Probability and statistics

- Probability also plays an vital role in architecture. The possibility of the form and building orientation depends on it.

3. Conclusions

Mathematical modeling therefore plays a key role in the formation of engineers, and there has been much research into how engineers should be taught the essential mathematics. Education is now expected to provide hard skill and soft skill to learners to form competent human resources so they can complete internationally. The most important aspect in a country's development is education. Education which is needed nowadays is an education that is

able to provide student learning experiences so that students have the ability to solve problems, think deeply, manage projects, and uses various tools of technology and information. One of the most important subjects to learn in the school is mathematics. The system of mathematical education in engineering formation is ripe for change-regularly frameworks, entry routes to the profession and school mathematics provision are all likely to experience major changes in the near future. Therefore there is a need to apply the mathematical knowledge that is required.

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