Applications and use of complex numbers

A complex number is that number which comprises a real and an imaginary part. It is mainly written in the form a + bi, where " a" is real numbers, and " i" is the imaginary unit with " b" as also the real part of the imaginary portion with the property i2 = âˆ'1.

The complex number contains the real number, but extends them by adding it to the extra number and corresponding expands the understanding of addition and multiplication.

Complex numbers was first explained by Gerolamo Cardano (Italian mathematician), he called it as " fictitious", when he was attempting to find the solution for the cubic equations. The solution for the cubic equation in radical function without any trigonometric form involve in it, it may need some calculations which contains the square roots of some of the digit containing negative numbers, even when the final solution was found it was of real numbers, this situation is known as casus irreducibilis. This reach ultimately to the proposition of algebra, which shows how's that with complex numbers is a explanation to occurs with every polynomial equation of the first degree or higher. Complex numbers thus form an algebraically bolted arena, where any polynomial equation partakes the root.

The directions for addition, subtraction, multiplication, and division of complex numbers were established by Rafael Bombelli. A more abstract formalism for the complex numbers was promoted by the Irish mathematician William Rowan Hamilton, who prolonged this idea to the concept of quaternions.

Complex numbers are used in a number of fields, including: engineering. When the underlying arena of numbers for a mathematical construct is the field of complex numbers, the name usually redirects that fact. Some of the examples are complex exploration, complex matrix, complex polynomial, and complex Lie algebra.

Let R be the set of all real numbers. Then a complex number is of the form

a + ib,

Where a and b implies in R and,

i2 = âˆš-1.

We signify the set of all complex numbers by C. “ a” is the real part and “ b” the imaginary part, written as a = Re z, b = Im z. “ i” is called the imaginary unit of the complex number. If a = 0,

then z = i b is a pure imaginary number. Two complex numbers are equivalent if and only if their real parts are identical and their imaginary parts are also identical.

Normal Form of the Complex Number

Complex Numbers contain a set of all numbers in the form a + bi where, “ a” is the Real Part and “ bi” is the Imaginary Part. It chances out the all numbers which may be inscribed in this form. For the numbers that are in regular Real form, there is no I part so b= 0. For eg., we may write 8 as 8 + 0i. Particular numbers, like 4 + 2i, which have both a real and imaginary part, with a = 4 and b = 2. And, like 9i have no Real part and may be written as 0 + 9i. We occasionally call these numbers like 9i, which have no Real part, as decently imaginary.

APPLICATION AND USES OF COMPLEX NUMBER:

Engineers use complex numbers in studying stresses and strains on rays and in studying resonance occurrences in structures as different as tall buildings and suspension bridges. The complex numbers come up when we see for the eigenvalues and eigenvectors of a matrix. The eigenvalues are the roots of the assured polynomial equation related with a matrix. The matrices can be quite large, possibly 100000 by 100000, and the related polynomials which is of very high degree. Complex numbers are used in studying the stream of liquids around hindrances, such as the flow around a pipe.

Mathematicians practice complex numbers in so many means, but one way is in learning infinite series, like

ez = 1+z+z2/2!+z3/3!+z4/4!+…,

Where z = x+i*y is a complex equation. This is a “ natural environment” to learn the series than on the real stripe. We are interested in a statement that comes from the above series: it is that

e(i*pi) = -1.

This brief equation tells four of the most important coefficients in mathematics, e, i, pi, and 1. Our calculator can be capable to switch complex numbers. We may be able to form that

e(i*t) = cos(t)+i*sin(t),

From which the previous end result follows. Just let t = pi.

We use complex number in following uses:-

IN ELECTRICAL ENGINEERING

The furthermost eg where we use “ complex numbers” as it is occasionally named as from electrical engineering, where imaginary numbers are used to keep track of the amplitude and phase of an electrical oscillation, such as an audio signal, or the electrical voltage and current that power electrical appliances. Complex numbers are used a great deal in electronics. The foremost aim for this is they make the whole topic of analyzing and understanding alternating signals much easier. This seems odd at first, as the concept of using a mix of real and ‘ imaginary’ numbers to explain things in the real world seem crazy! Once you get used to them, however, they do make a lot of things clearer. The problem is to understand what they ‘ mean’ and how to use them in the first place. To help you get a clear picture of how they’re used and what they mean we can look at a mechanical example…

The above animation shows a rotating wheel. On the wheel there is a blue blob which goes round and round. When viewed ‘ flat on’ we can see that the blob is moving around in a circle at a steady rate. However, if we look at the wheel from the side we get a very different picture. From the side the blob seems to be oscillating up and down. If we plot a graph of the blob’s position (viewed from the side) against time we find that it traces out a sine wave shape which oscillates through one cycle each time the wheel completes a rotation. Here, the sine-wave behavior we see when looking from the side ‘ hides’ the underlying behavior which is a continuous rotation.

We can now reverse the above argument when considering a. c. (sine wave) oscillations in electronic circuits. Here we can regard the oscillating voltages and currents as ‘ side views’ of something which is actually ‘ rotating’ at a steady rate. We can only see the ‘ real’ part of this, of course, so we have to ‘ imagine’ the changes in the other direction. This leads us to the

idea that what the oscillation voltage or current that we see is just the ‘ real’ portion’ of a ‘ complex’ quantity that also has an ‘ imaginary’ part. At any instant what we see is determined by a phase angle which varies smoothly with time

The smooth rotation ‘ hidden’ by our sideways view means that this phase angle varies at a steady rate which we can represent in terms of the signal frequency, ‘ f’. The complete complex version of the signal has two parts which we can add together provided we remember to label the imaginary part with an ‘ i’ or ‘ j’ to remind us that it is imaginary. Note that, as so often in science and engineering, there are various ways to represent the quantities we’re talking about here. For example: Engineers use a ‘ j’ to indicate the square root of minus one since they tend to use ‘ i’ as a current. Mathematicians use ‘ i’ for this since they don’t know a current from a hole in the ground! Similarly, you’ll sometimes see the signal written as an exponential of an imaginary number, sometimes as a sum of a cosine and a sine. Sometimes the sign on the imaginary part may be negative. These are all slightly different conventions for representing the same things. (A bit like the way ‘ conventional’ current and the actual electron flow go in opposite directions) The choice doesn’t matter so long as you’re consistent during a specific argument.

We can now consider oscillating currents and voltages as being complex values that have a real part we can measure and an imaginary part which we can't. At first it seems pointless to create something we can't see or measure, but it turns out to be useful in a number of ways.

SIGNAL ANALYSIS:

Complex numbers are used in signal analysis and other fields for a convenient description for periodically varying signals. For given real functions representing actual physical quantities, often in terms of sines and cosines, corresponding complex functions are considered of which the real parts are the original quantities. For a sine wave of a given frequency, the absolute value | z| of the corresponding z is the amplitude and the argument arg (z) the phase.

IMAGINARY NUMBER IN REAL LIFE:

Since complex numbers are often called " imaginary numbers," they often become suspect, seen as mathematicians' playthings. This is far from the truth, although not easy to prove. If you were to spend some time in a university library looking through physics, engineering, and chemistry journals or through books in these disciplies, you would find many applications of complex

numbers. But this is difficult, since the uses are often buried under a lot of terminology.

Complex numbers enter into studies of physical phenomena in unexpected ways. There is, for example, a differential equation with coefficients like a, b, and c in the quadratic formula, which models how electrical circuits or forced spring/damper systems behave. A car equipped with shock absorbers and going over a bump is an example of the latter. The behavior of the differential equations depends upon whether the roots of a certain quadratic are complex or real. If they are complex, then certain behaviors can be expected. These are often just the solutions that one wants.

In modeling the flow of a fluid around various obstacles, like around a pipe, complex analysis is very valuable to transforming the problem to a much simpler problem.

When economic systems or large structures of beams put together with rivets are analyzed for strength, some very large matrices are used in the modeling. The eigenvalues and eigenvectors of these matrices are important in the analysis of such systems. The character of the eigenvalues, whether real or complex, determines the behavior of the system. For example, will the structure resonate under certain loads. In everyday use, industrial and university computers spend a significant portion of their time solving polynomial equations. The roots of such equations are of interest, whether they are real or complex.