

Complex numbers

After completing this section, students should be able to do the following.

- Explain why complex numbers are important in circuits and electromagnetics.
- Sketch a complex number in rectangular and polar coordinates, and label magnitude, phase, real and imaginary parts.
- Derive the magnitude and phase from the real and imaginary parts of a complex number.
- Derive the real and imaginary parts of a complex number from the magnitude and phase.
- Explain how Euler's formula relates to sinusoidal signals and complex numbers.
- Describe which coordinate system to use when adding/subtracting and which one when multiplying/dividing two complex numbers.
- Apply complex numbers to solve a circuit element's impedance if the phasor of current through and voltage on it are known.
- Apply complex numbers to solve for voltage on a circuit element if phasor of current and impedance are known.
- Apply complex conjugate operation to a complex number in rectangular and polar coordinates.
- Derive magnitude of a complex number from a complex number and complex conjugate of the same number.
- Visualize the position of purely imaginary and purely real complex numbers on a unit circle.
- Convert visually purely imaginary and purely real complex numbers from rectangular to polar coordinates and vice versa.
- Prove that the magnitude of a complex number is a square root of the product of the number and its complex conjugate.