PACE Electrical Engineering

Scientific Notation

Overview

Scientific notation is a compact way of expressing very large or very small numbers. It takes advantage of exponents to avoid using a long string of digits. A number expressed in scientific notation has the following format:

$$\pm a \times 10^{b}$$

where a is a decimal number between 1 and 10 (equal to or greater than 1 but less than 10)[1] and b is an integer and is the exponent for the appropriate power of 10. The $\pm$ symbol in front of the a indicates that the number could be either positive or negative. Examples of numbers expressed in scientific notation are

$$1.6 \times 10^{3}$$

$$-5.1 \times 10^{5}$$

$$7.112 \times 10^{-6}$$

The following table gives examples of numbers that are not expressed in scientific notation and the reason why it's not:

$4.06 \times 10^{3.1}$	The exponent (3.1) is not an integer
11.6×10^{-9}	The decimal part of the number (11.6) is not between 1 and 10.
-0.53×10^{3}	The decimal part of the number (0.53) is not between 1 and 10.
$11.6 \times 10^{-\pi}$	The exponent ($-\pi$) is not an integer
$\pi \times 10^{5}$	Although π is between 1 and 10, it is not a decimal

Converting Numbers to Scientific Notation

The number 365,000 expressed in scientific notation is 3.65×10^{5}. To convert a number to scientific notation, do the following:

1. Write down the number: 365000
2. If the number does not have a decimal point, put one at the end: 365000.
3. Move the decimal point to the right or left until there is exactly one non-zero digit to the left of the decimal point: 3.65000
4. Count how many places you had to move the decimal point and in which direction: five to the left.
5. Drop any leading or trailing zeros. The result is a: $a = 3.65$
6. b is the number the places you had to move the decimal point. b is positive if you moved the decimal point to the left and negative if you moved the decimal point to the right: $b = 5$.

[1] Formally, we would write $0 \leq a < 10$.