Even though video electronics runs on DC, the DC usually carries useful information (video, audio) in variations that appears much like AC. Much of that information is in the form of one or more sine waves. Both current and voltage can appear as sine waves. Sine waves have the following properties: frequency, period, amplitude, and phase.

In a DC circuit, or in a purely resistive AC circuit, there are no differences in phase between voltage and current. However, differences in phase can exist between voltage and current and between resistance and reactance in those electronic circuits containing reactance (inductance and/or capacitance).

Vectors provide a useful mathematical model for representing phase differences within a sinusoidal (sine wave like) electrical signal, and between sinusoidal electrical signals. When vectors are used in this way, they are referred to as phasors.

Phasors greatly simplify the mathematics required to analyze sine waves. Also, drawing two phasors is a more compact way of representing the phase relationships between two sine waves than it would be to draw the two sine waves.

Magnitude and Direction

Just like vectors, phasors have a magnitude and a direction. Phase direction is in units of degrees or, less commonly, radians. Just like with circles, the phase of sine waves can range from 0 degrees, inclusive, through 360 degrees, exclusive. A value of phase less than zero or greater than 360 degrees are equivalent to that phase value modulo 360; for example, a phase of 520 is equal to a phase of 520 modulo 360, or 160. The direction of phasors follows the above rules for sine waves and circles.

If a phasor rotates counterclockwise from 0 through 360 degrees with a constant angular velocity, the value of its y-axis component will follow the shape of a sine wave, and will represent one complete cycle of the sine wave.

The magnitude of a phasor is either the peak voltage or current of the sine wave being modeled, or the RMS voltage or current; the latter is more common in engineering applications.

Phasors in Rectangular Coordinates

The conventional representation of phasors in an x-y coordinate system define a phase of zero when the phasor runs along the x axis oriented in the positive direction.

The unit phasor is defined to be a phasor of length one.

The instantaneous value is the value of the y coordinate of a phasor at a given phase angle. The values correspond to the formula y = sin (theta), where theta is the phase angle. The largest instantaneous value occurs when sin (theta) is 1, and can represent peak voltage or peak current in a sinusoidal electrical signal (1 volt or 1 amp in the case of the unit phasor).

Phase Differences

If two sine waves have the same phase angle, they are in phase. If not, there is a phase shift between them. The sine wave that reaches its peak earlier in time (when starting at the point where the value for the x axis is zero) is said to be *leading* the other sine wave by the amount of the phase shift between them. The other sine wave is said to be *lagging* the sine wave that reaches its peak earlier in time.

Other Properties Represented by Phasors

The frequency of a sine wave can be represented by a constant angular velocity of the phasor. A phasor will move through a given quantity of cycles per second if it has a given constant angular velocity. Cycles per second is a unit of frequency that is referred to as Hertz (Hz).