

Wavelength and Frequency Intrinsic Units

The Duality of λ and 2π

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The value of 2π is a convergence point wherein it can represent both frequency and angular frequency, an “intrinsic frequency”. In its angular duality, 2π represents a complete revolution, or a circle. In wave motion, a wavelength represents the length between corresponding points of a wave. One wavelength, an “intrinsic wavelength”, is representative of a complete wave cycle, which can be represented as a circle when its linear length is formed into a circle with a circumference length of one. Thus, an “intrinsic wavelength” also has a duality as a linear length and a length that represents the circumference of a circle.

The dualities of wavelength and frequency can be exploited in the framework of right triangles when wavelength and frequency are used as the elements of right triangles, Figure 1. The values in parenthesis represent the respective angular values of wavelength and frequency, which synchronizes the two triangles to the same angular basis.

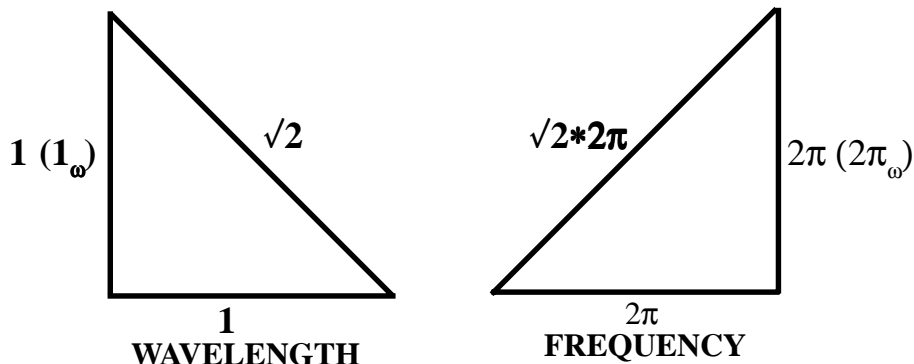


Figure 1

For electromagnetic waves, the constant of proportionality between wavelength and frequency is the speed of light (SOL). In its algebraic form, equation (1), the constant of proportionality is represented by the small letter **c**, **f** is frequency and λ wavelength.

$$f = c / \lambda \quad \text{or} \quad \lambda = c / f \quad \text{or} \quad c = f * \lambda \quad (1)$$

Using the notation for the triangle pair in Figure 2, the constant of proportionality, **k**, is determined by equation (2), where the vertical leg of one triangle is multiplied by the hypotenuse of the other triangle.

$$k = Y_w * Z_f = Y_f * Z_w \quad (2)$$

When the two products are equal the triangle pairs are mutually related, one is the inverse of the other.

The above equation is valid for any angle when one leg of each triangle is maintained as an “intrinsic wavelength” and an “intrinsic frequency”, each representing their dual nature. The vertical legs were chosen for the constant values.

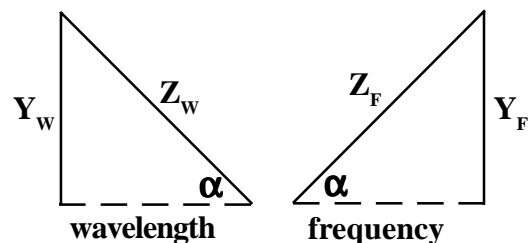


Figure 2