

Complex Lorentzian (From Lab Actor Program)

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In this paper, I will sepperate the complex Lorentzian equation used in the Lab Actor program into real and imaginary components.

General Equation

$$z(f) = \frac{Ae^{i\theta}}{f - f_0 + i\gamma}$$

Derivation

Mutltiple by complex conjugate.

$$\frac{Ae^{i\theta}}{f - f_0 + i\gamma} * \frac{(f - f_0) - i\gamma}{(f - f_0) - i\gamma} \quad (1)$$

Use Euler's identity in the numerator, and simplify the denominator.

$$\frac{A}{(f - f_0)^2 + \gamma^2} [\cos(\theta) + i \sin(\theta)] * ((f - f_0) - i\gamma) \quad (2)$$

Distribute factors in the numerator.

$$\frac{A}{(f - f_0)^2 + \gamma^2} [((f - f_0) \cos(\theta) + \gamma \sin(\theta)) + i((f - f_0) \sin(\theta) - \gamma \cos(\theta))] \quad (3)$$

Finally

$$Re(z(f)) = \frac{A}{(f - f_0)^2 + \gamma^2} ((f - f_0) \cos(\theta) + \gamma \sin(\theta))$$

$$Im(z(f)) = \frac{A}{(f - f_0)^2 + \gamma^2} ((f - f_0) \sin(\theta) - \gamma \cos(\theta))$$