Lab Actor Lorentzian

James Shaddix

June 15, 2018

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

General Equation

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

Derivation

Mutltiple by complex conjugate.

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

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

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

Distribute factors in the numerator.

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

Finally

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

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