squeezing

January 24, 2025

Notes on Squeezing Parameter λ:

The paper which this solver is based on essentially uses 3 squeezing parameters (r, λ_{dB}, and λ)

When the **squeezing parameter** λ_{dB} is expressed in **decibels (dB)**, it represents the squeezing level or the reduction in noise (uncertainty) for one quadrature of a quantum state relative to the standard quantum limit (SQL).

The **squeezing parameter** r (the real part of the complex squeezing parameter $z = re^{i\theta}$) quantifies the amount of squeezing and is related to the squeezing level in dB (λ) as:

$$\lambda = -10\log_{10}(e^{-2r}),$$

and

$$r = -\frac{1}{2}\ln(10^{\frac{-\lambda}{10}})$$

In-phase quadrature power gain

*In-phase **power gain** or loss* is given by:

$$G_X = e^{-2r}.$$

The in-phase quadrature power gain G_X can be expressed directly in terms of λ_{dB}:

$$G_X = 10^{\lambda_{dB}/10}.$$

in this paper however, the actual λ used is one such that:

$$r = -\ln(\lambda)$$

and

$$G_X = \lambda^2$$

thus relating λ_{dB} and λ we get:

$$\lambda = \sqrt{10^{\frac{\lambda_{dB}}{10}}}$$