1. Fitting one resonance

Following the TeachSpin Quantum Analogs manual, we model the system close to a resonace frequency as a damped, driven, harmonic oscillator. Let p denote the air pressure, let ω_0 denote the specific resonance frequency, and let γ, and take K and γ to be constants corresponding to the power of the speaker and the damping of the system respecitively. Then, we have the linear differential equation

$$\frac{d^2p}{dt^2} + 2\gamma\frac{dp}{dt} + \omega_0^2 p = K\cos(\omega t)$$

Then, we solve for the amplitude A of the steady state solution, which will gives the long term behavior of the resonace. Combining the solution to the amplitude A with the assumption $\omega_0 \gg \gamma$, this simplifies to the model.

$$|A(\omega)| = \frac{K}{\sqrt{(\omega_0 - \omega)^2 + \lambda^2}}$$

For some variable λ. This gives a model for fitting a single peak. Combining this with the MATlab Curve Fitting Toolbox with free variables K, ω_0, and λ, we can accuractely fit the given data such as in /**/.