# Theory

In building the theory of this work we consider a system that couples a cavity resonator to two magnons (although this may be extended to any number of oscillators).

The driven field is provided through a microstrip line (denoted in equation (\ref{eq:msl-ham}) as ``msl"), and theoretically supports all frequencies. We assign to this the creation (annihilation) operator \(\hat{p}\_k\) (\(\hat{p}\_k^\dagger\)).

We begin with the definition of the system's Hamiltonian \(

\), where each expands to

\begin{equation}

\label{eq:int-ham}

\end{equation}

\begin{equation}

\label{eq:non-int-ham}

\end{equation}

The microstrip line requires a continuous integral over all supported input frequencies.

This may be seen both in equation (\ref{eq:non-int-ham}) and in equation (\ref{eq:msl-ham})

\begin{equation}

\label{eq:msl-ham}

\end{equation}

Note that in building this Hamiltonian, we chose not to include terms of direct coupling between \(\hat{b}\_0\), and \(\hat{b}\_1\).

Neglecting counter-rotating terms and using the input-output theory\cite{shrivastava-2024,walls-2007}, we obtained the equations of motion.

\begin{equation}

\label{eq:initial-time-motion}

\end{equation}

\begin{equation}

\label{eq:final-time-motion}

\end{equation}

The parameter for such a system is worked out to be\cite{walls-2007}

\begin{equation}

\label{eq:s21-analytical}

\end{equation}

where s the input field operator. We then obtain the transmission spectrum numerically, as shown in Fig. \ref{fig:}.