

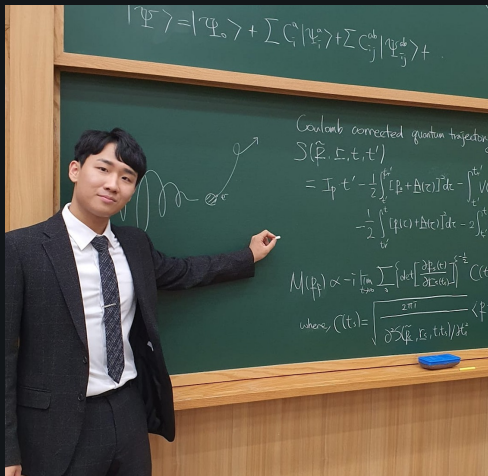
# Using QComponents for parametric design

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# Small Backgrounds about me



Qiskit Advocate (2021 ~ )

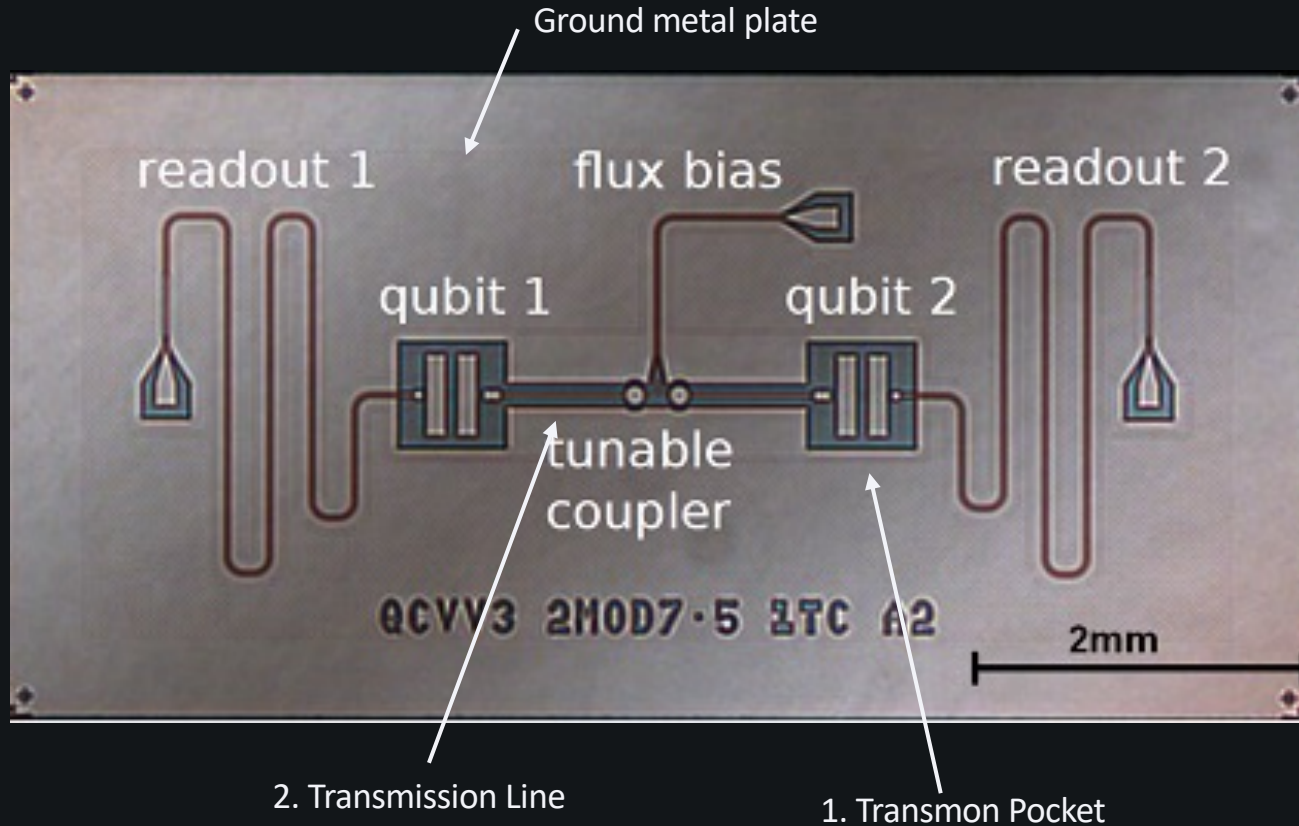
Seoul National University (Physics and Computational Science)

Current Research Field: Quantum dot qubit hardware simulation and machine learning adopted quantum control.

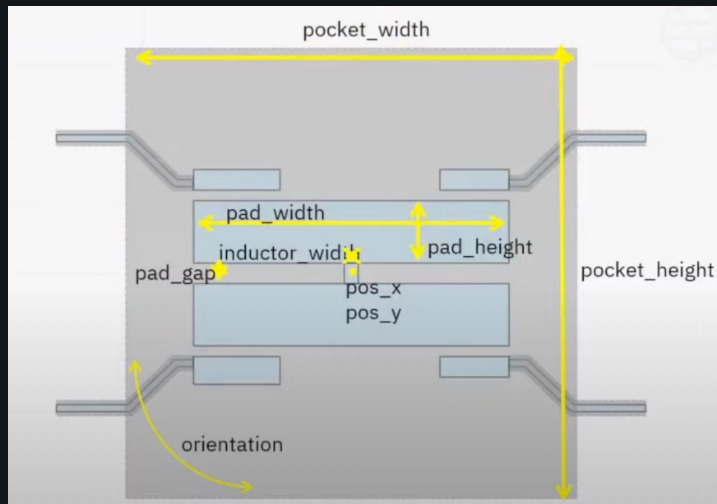
Started Qiskit-Metal almost 1 year ago at 1st Qiskit-Hackathon-Korea.

(<https://medium.com/qiskit/how-these-researchers-designed-quantum-processors-at-a-hackathon-using-qiskit-metal-양자-프로세서-설계를-b3167210b403>)

# Transmon Qubit Circuit



# Transmon Pocket



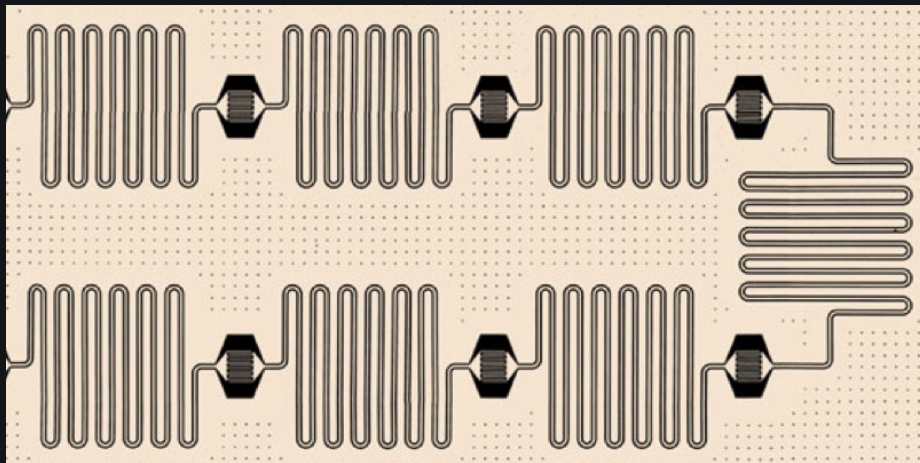
$E_J/E_C$  is one of the critical factors in the superconducting qubit.

To control  $E_C$ , we can modify the geometry of the conductor. (With larger pads, we can get large capacitance, which means small capacitance energy).

Two good introductory references:

1. Thomas E. Roth, et al., “An Introduction to the Transmon Qubit for Electromagnetic Engineers”
2. M. H. Devoret, et al., “Superconducting qubits: A short review”

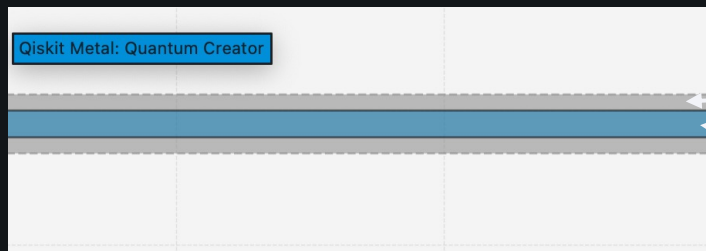
# Transmission Line



Co-planar waveguides (CPW) are capacitively connected to the qubit or other CPW.

The resonant frequency of the CPW is important to prevent crosstalk.

We can modulate the resonant frequency of CPW by changing its geometry (length, width, and gap)



cpw\_gap

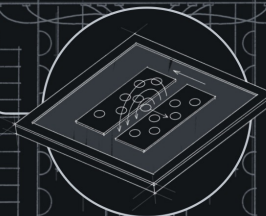
cpw\_width

How can we control all of these factors  
to design a superconducting qubit circuit?

How can we control all of these factors to design a superconducting qubit circuit?

**Qiskit**

| quantum device  
design



# Jupyter notebook demonstration