

QuantumPro

Electromagnetic (EM) and quantum analysis environment for quantum circuit designers

Introduction

Keysight QuantumPro is an EM (electromagnetic) design environment for quantum circuit designers, seamlessly combining circuit analysis, EM modeling, and quantum parameter extraction in one integrated workflow. Precision is paramount with QuantumPro simulators, spanning FEM for frequency domain and eigenmode, and Momentum for frequency domain analyses. Revolutionize your workflow with automated quantum parameter extraction from both frequency-domain and eigenmode solutions. Effortlessly optimize with built-in design automation via ADS/QuantumPro Python scripting. Elevate your EM flow with kinetic inductance modeling. Experience quantum innovation simplified with QuantumPro.

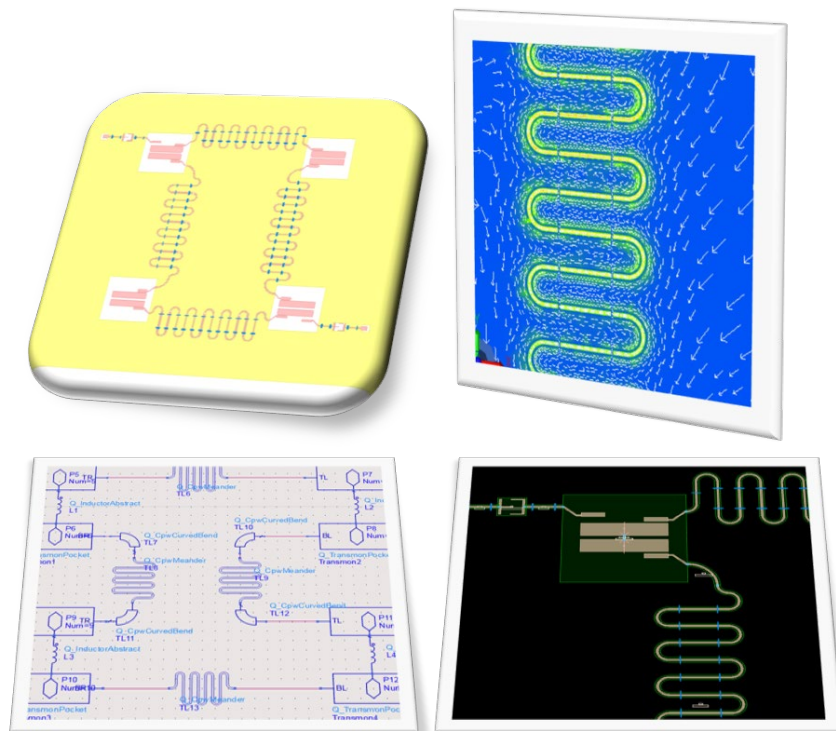


Figure 1. QuantumPro allows for analyzing superconducting quantum circuits including the EM analysis and nonlinear quantum effects.

QuantumPro Capabilities for Quantum Designers

Layout

- Quantum-specific layout library of fully parametrized components.
- Automatic airbridges are added to the CPW lines and meander-lines.

Full EM Analysis

- Support to full-wave frequency sweep for the superconducting circuits with the Finite Element Method (FEM) and Method of Moment (MoM).
- Adaptive and linear sweeps for the accurate calculation of circuit responses.
- Mesh refinement and customization for simulation at an optimal computational cost.

Energy Participation Analysis

- Support to the FEM eigenmode solver to accurately determine the eigenfrequencies of quantum circuit elements.
- Resistive loading to find external quality factor and photon lifetime (T_1).

Quantum Parameter Extractions

- Automated quantum parameter extraction.
- Freq-Domain Extraction: It will show the coupling terms only between neighboring qubits and resonators.
- Eigenmode Extraction: It will show the coupling terms even between distant qubits and resonators.

Co-Simulation

- Support to coupling the EM and the circuit flows leveraging co-simulation for quantum applications.

Kinetic Inductance

- Modeling of the kinetic inductance of superconductors in the EM flow.

QuantumPro Application Example

Here are some current application examples for QuantumPro:

Kinetic Inductance Superconducting Circuit

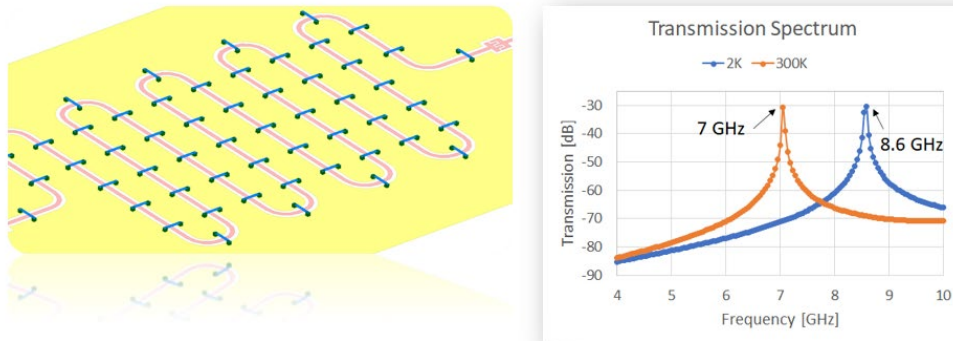


Figure 2. QuantumPro supports various superconducting materials with kinetic inductance properties. PathWave ADS Quantum Technology allows for exploring the temperature-dependent performance of superconducting quantum circuits.

Single Superconducting Qubit Circuit

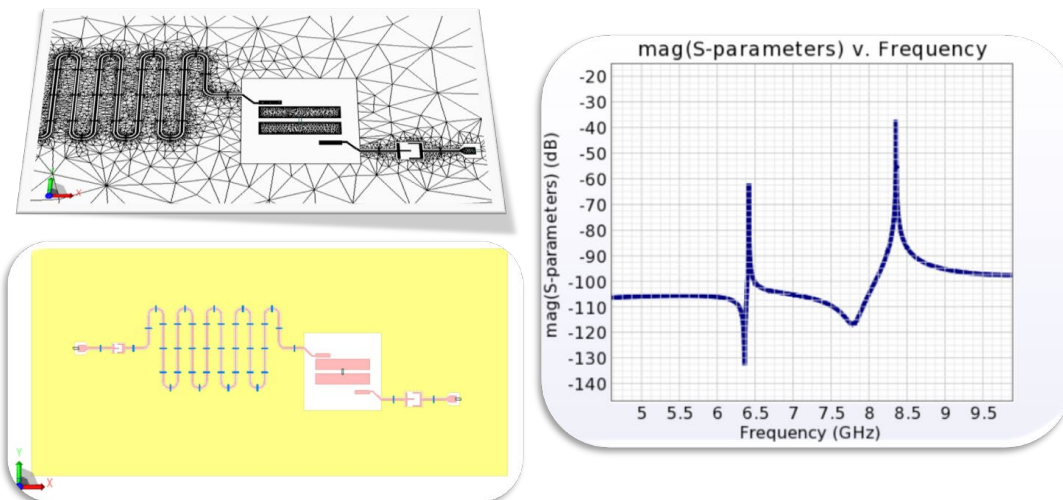


Figure 3. A simple single qubit example in QuantumPro.

Four Superconducting Qubits Circuit



Figure 4. A four qubits circuit example in QuantumPro.

QuantumPro Product Configurations

The table below shows the different analyses in W3037E PathWave QuantumPro

Analysis	Full EM analysis			Energy participation analysis
Solution domain	Quasi-static frequency domain	Frequency domain	Frequency domain	Eigenmode
Solver	Momentum RF	Momentum microwave	FEM	FEM
Quantum parameter extraction method	Quasi-static blackbox quantization	Blackbox quantization	Blackbox quantization	Energy Participation Ratio (EPR)
Computational complexity	Low	Medium	High	Medium

QuantumPro Bundles and Element

- QuantumPro **bundles** along with powerful ADS multi-technology 3D assembly layout for RF modules and RF packaging:
 - W3704B with PathWave ADS Core, EM Design, Layout, QuantumPro
 - W3706B with PathWave ADS Core, EM Design Core, Layout, QuantumPro, RF Ckt Sim
 - W3715B with PathWave ADS Core, EM Design Core, Layout, QuantumPro, HB
- QuantumPro element W3037E is purchased as an add-on element to an existing ADS environment.
- EM HPC accelerator W3039E enables parallel EM simulation to speed up analysis for frequency domain analysis. Multiple accelerators can be added to increase speedup from 5x to 20x depending on the nature of the problem.

Take the Next Step with QuantumPro

For more information or to request a free trial of QuantumPro and ADS, visit:

- <https://www.keysight.com/find/quantum-eda>
- <https://www.keysight.com/products/W3037E>



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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