



## QTCAD v2.1 - Advanced Quantum Chip Design Software

Nanoacademic offers an innovative and unique first-principles computer-aided design tool dedicated to spin-qubit and superconducting-qubit modeling. **This is QTCAD®.**

**QTCAD®** (Quantum-Technology Computer-Aided Design) is a multiscale (finite-element method and atomistic) simulator used to predict the performance of spin-qubit and superconducting-qubit devices before their production. These predictions can result in huge savings in terms of time and money, which enables the exploration of more design scenarios, similar to practices in the semiconductor industry. **QTCAD®** uses Poisson, Schrödinger, and Maxwell solvers to calculate design critical parameters and predict quantum devices performance based on key figures of merit.

### Key features

#### QTCAD® semiconducting device modeling features:

- **NEW!** QTCAD® *Builder*: Simplifies 3D device model building from layout files by emulating fabrication process
- **NEW!** 3D quantum device visualizer including boundaries, regions & materials for pre-processing, presentation, or debugging purposes.
- **IMPROVED!** Schrödinger–Poisson solver with fixed number of confined carriers and faster convergence for single-electron transistor design
- **NEW!** DFT-based strain and band alignment in Si/Si<sub>1-x</sub>Ge<sub>x</sub> and Ge/Si<sub>x</sub>Ge<sub>1-x</sub> heterostructures and new Ge<sub>1-x</sub>Sn<sub>x</sub> material
- A sub-K electrostatics solver for quantum dot confinement potentials in semiconductors with adaptive meshing
- A many-body Schrödinger solver for electrons and holes
- A master equation solver for quantum transport calculations in the sequential tunneling regime (Coulomb blockade)
- An NEGF\* solver for non-equilibrium quantum statistics and quantum transport in two-probe devices
- A computationally efficient workflow for charge stability diagrams of few-quantum dot systems including cross-capacitive effects
- Treatment of Bloch oscillations in the multi-valley-effective-mass theory (MVEMT) solver
- A Hybrid 3D/1D quantum-well Schrödinger-Poisson solver
- Possibility to define custom defect charge-density profiles to model point charges and dopants
- A general workflow for electric-dipole spin resonance (EDSR) interfacing with QuTiP for both electrons and holes

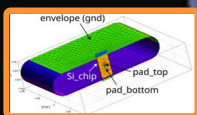
#### QTCAD® Atoms for multiscale simulations of quantum dots using the atomistic tight-binding (TB) method:

- **NEW!** Valley-phase calculator enabling, e.g., electron shuttling fidelity calculations
- **IMPROVED!** Atomic structure builder for arbitrary 3D geometries with periodic boundary conditions & nonidealities (random alloy, roughness)
- A TB electronic structure solver which accounts for the effects of strain, magnetic fields, and spin-orbit coupling
- Various analysis tools such as atomistic wavefunction visualizers, matrix-element calculators, and g-tensor calculators
- Interfaces to QTCAD®'s FEM modeling capabilities like inclusion of a gate-induced confinement potential enabling multiscale simulations

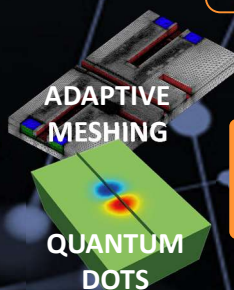
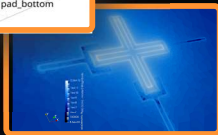
#### QTCAD® superconducting circuit modeling features:

- **NEW!** The Maxwell eigensolver now supports inductive lumped port, enabling, e.g., extraction of transmon eigenmodes
- A capacitance matrix solver based on an adaptive-mesh linear Poisson solver to handle typical sharp corners & embedded 2D surfaces
- A frequency-domain finite-element Maxwell solver to compute the eigenmodes of superconducting resonators and cavities

\* Non-equilibrium Green's functions



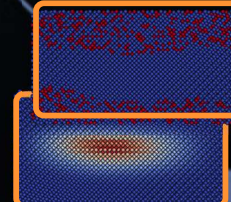
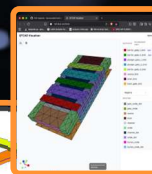
SUPERCONDUCTING QUBITS



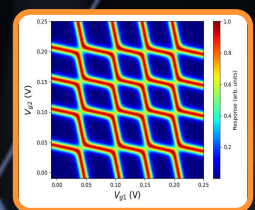
QUANTUM DOTS



NEW TOOLS: BUILDER & VISUALIZER



ATOMISTIC MODELING



QUANTUM TRANSPORT

Contact us to test QTCAD® and get your free-trial version now!

Single-user and group/team licenses

Check out to teach students:



Full release notes  
Documentation Portal



User Portal to log-in



Follow us on and