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(54) Title: A COMPUTER-IMPLEMENTED METHOD FOR DETERMINING A CONTROL SEQUENCE FOR PERFORMING A SERIES OF QUBIT INTERACTIONS TO SIMULATE A FERMIONIC HAMILTONIAN, A COMPUTER PROGRAM PRODUCT, A QUANTUM CIRCUIT, AND A METHOD FOR DETERMINING A CHARACTERISTIC OF A SYSTEM

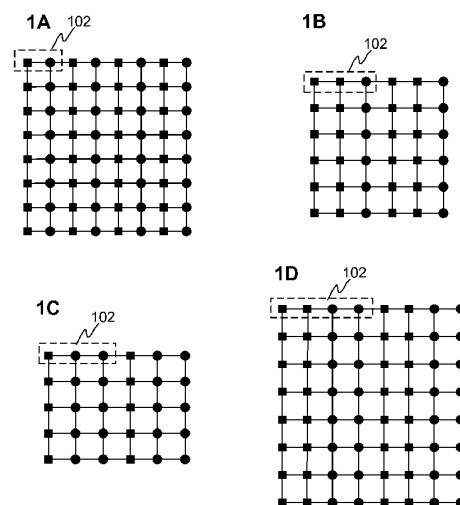


FIG. 1

(57) Abstract: A computer-implemented method for determining a control sequence for performing qubit interactions on a plurality of qubits on a quantum device with a square qubit layout to simulate a fermionic Hamiltonian, wherein the method comprises receiving input parameters of the fermionic Hamiltonian to be simulated, projecting the associated fermionic lattice to the qubit layout by such that qubits assigned with fermionic modes are termed physical qubits P and qubits not assigned with any fermionic mode are termed ancilla qubits A, wherein the arrangement of physical qubits P and ancilla qubits A in each single horizontal line of the qubit layout is the same. The method additionally comprises associating each physical qubit P with at least one edge operator E and one vertex

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operator V, mapping each fermionic operator to a qubit operator based on the edge operators E and vertex operators V, and determining a control sequence of qubit operators comprising at least the qubit operators determined by the mapping.