Rotation Primitives in Quantum Compilation

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A prominent technological approach for the implementation of general-purpose quantum computers (QC) is based upon planar interconnections of mesoscopic qubits in the form of superconducting semiconductor circuits (SSC). Examples include the Rigetti and IBM machines that utilize SSC qubits based on Josephson junction devices. The programming model for this class of QC is usually based upon a set of single and dual qubit operators or "gates" such as those comprising the "Clifford+T" group. Operationally, gates from the primitive group are mapped to a smaller subset of single and controlled rotation operators that are compatible with the technology platform via the use of a quantum compiler. We show that such rotation operators may be implemented in several different equivalent forms that are directly related to the solid angle rotation formulas known as the Euler and Tait-Bryant set. Furthermore, we show that the technology mapping portion of a quantum compiler can take advantage of these different forms of rotation operators by choosing a subset that improves a specified optimization criterion. A specific example is shown whereby fidelity is increased by choosing an appropriate set of rotation operations that maximizes the number of rotations performed in the phase plane and minimizes the rotations in the probability amplitude plane of the Bloch sphere.