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Systematically Generated Two-Qubit Braids for Fibonacci Anyons DANIEL ZEUCH, Department of Physics and NHMFL, Florida State University, CAITLIN CARNAHAN, Department of Computer Science, Florida State University, N. E. BONESTEEL, Department of Physics and NHMFL, Florida State University — We show how two-qubit Fibonacci anyon braids can be generated using a simple iterative procedure which, in contrast to previous methods, does not require brute force search [1]. Our construction is closely related to that of [2], but with the new feature that it can be used for three-anyon qubits as well as four-anyon qubits. The iterative procedure we use, which was introduced by Reichardt [3], generates sequences of three-anyon weaves that asymptotically conserve the total charge of two of the three anyons, without control over the corresponding phase factors. The resulting two-qubit gates are independent of these factors and their length grows as $\log 1/\epsilon$, where ϵ is the error, which is asymptotically better than the Solovay-Kitaev method.

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