qGenerator: A Novel Way to Create Qudit Quantum Error Correction Codes

Moorthy, Arun (School: BASIS Scottsdale)

Quantum computing promises to provide algorithmic speedups for a number of tasks; however, similar to classical computing, effective error-correcting codes are needed. Current quantum computers require costly equipment to control each particle, so having fewer particles to control is ideal. Although traditional quantum computers are built using qubits (2-level systems), qudits (more than 2-levels) are appealing since they can have an equivalent computational space using fewer particles, meaning fewer particles need to be controlled. Currently, qudit quantum error-correction codes are available for different level qudit systems; however, these codes have sometimes overly specific constraints. When building a qudit system, it is important for researchers to have access to many codes to satisfy their requirements. My project addresses two methods to increase the number of quantum error correcting codes available to researchers. The first method is generating new codes for a given set of parameters. The second method is generating new error-correction codes by using existing codes as a starting point to generate codes for another level (i.e. a 5-level system code on a 2-level system). So, this project builds a website that researchers can use to generate new error-correction codes or codes based on existing codes.

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