

## A NEW APPROACH TO QUANTUM ERROR CORRECTING CODES

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ABSTRACT. In general, a quantum code is defined by using discrete single qubits. However, more extended code class over  $\{0, 1, w, \bar{w}\}$  can be defined by using relation between the set  $\{00, 01, 10, 11\}$  and  $\{0, 1, w, \bar{w}\}$  as the following:  $0 \rightarrow 00, 1 \rightarrow 11, w \rightarrow 10, \bar{w} \rightarrow 01$ . In order to make it, quantum entanglement can be useful. In a quantum case, there is a complicated structure which is called quantum entanglement. If two-bit elements of the set  $\{00, 01, 10, 11\}$  are associated to entangled pairs, then operations can be applied as acting a single qubit. When we consider two-qubit system, error matrices are represented by more extended matrices whose diagonal elements are Pauli matrices. These matrices are entangled and they cannot be written as product of two different Pauli matrices. Hence, we can obtain a large class of quantum codes by composing these error matrices and codes over  $\{0, 1, w, \bar{w}\}$  which are constructed by entangled qubits. Generally, it is difficult that detection and correction of errors which are occur in entangled qubits. The new class of quantum codes might solve this problem that occurs in entangled qubits. Hence, in this study we introduce these type of codes.

### References

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