

MATERIALS

PERFORMANCE COMPARISON BETWEEN CORPSE AND CORP²SE

We evaluate the performance of CORP²SE and compare it with that of CORPSE. Figure. 1 (a) shows the trajectories targeting the $(\pi)_0$ operation by them with ORE from the initial state \vec{z} . We can observe that both CPs compensate ORE, compared with the elementary $(\pi)_0$ operation.

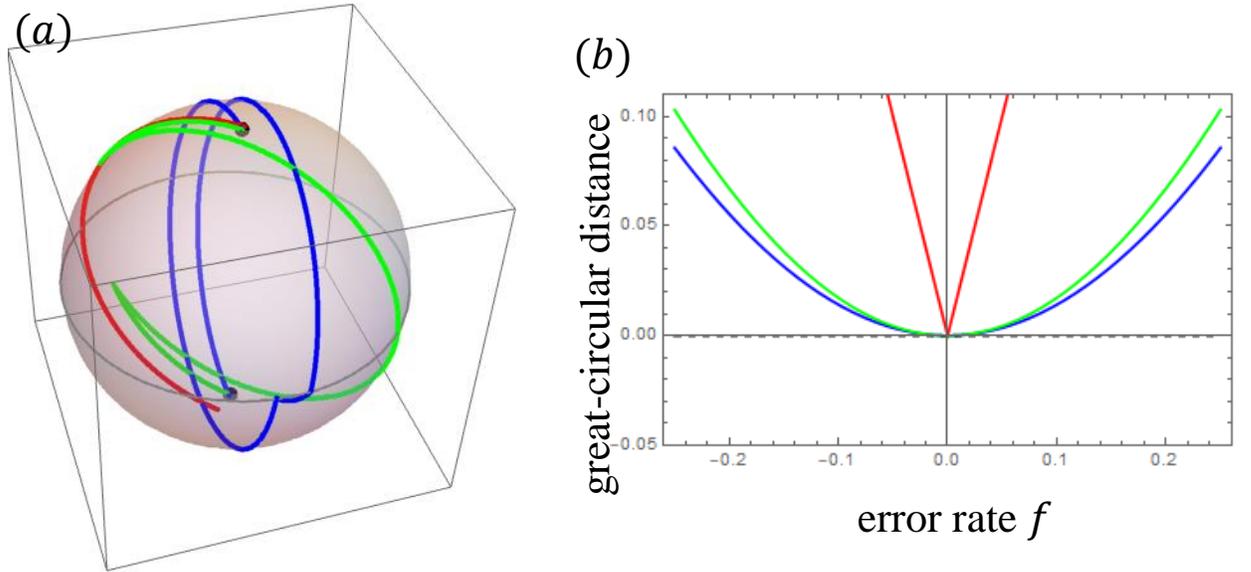


FIG. 1. The performance of the ORE robust CPs. In (a), the trajectories with ORE for two CPs targeting the $(\pi)_0$ operation are drawn. The red, green, and blue lines represent the elementary π operation, CORPSE, and CORP²SE, respectively. The ORE rate is set to be $f = 0.1$. The initial state is \vec{z} . In (b), we plot the accuracy of these operations defined by the great-circular distance as a function of the ORE rate f . The colours of the curves represent the same operations as those in (a).

To examine the performance of the CPs more precisely, we consider the great-circular distance on the Bloch sphere. For the $(\pi)_0$ operation on the state corresponding to \vec{z} (north pole), the ideal operation maps the initial state \vec{z} to $-\vec{z}$. The great-circular distance between $-\vec{z}$ and the end point of the operation with ORE from \vec{z} has a positive value as a function of f . We characterise the accuracy of the π rotation using the great-circular distance from $-\vec{z}$. The smaller the distance, the better the accuracy. Figure. 1 (b) plots the great-circular distance between $-\vec{z}$ and the end point of the elementary π operation, CORPSE, and CORP²SE initiated from \vec{z} . While the absolute value of the error rate f increases, the distance increases for any case, and the accuracy of the π operation decreases. The distance for CORPSE and CORP²SE behaves as $\propto f^2$ around $f = 0$, whereas the distance for the elementary π operation behaves as $\propto |f|$. This behaviour is due to the definition of the ORE robustness. CORP²SE provides slightly better accuracy than CORPSE in the entire region of f , although the total CORP²SE operation (non-dimensionalised) time is longer than that of CORPSE: $7\pi/3$ for CORPSE and $7\pi/2$ for CORP²SE.