Title

Authors

Quantum computation has been studied mainly through the use of linear algebra. In this framework, a qubit can be expressed using the Dirac notation as $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$, where $|0\rangle = \left(\begin{smallmatrix}1\\0\end{smallmatrix}\right)$ and $|0\rangle = \left(\begin{smallmatrix}0\\1\end{smallmatrix}\right)$ form a basis of $\mathbb{C}^2$. An $n-$qubit system however, is defined and transformed in $\mathbb{C}^{2^n}$. This exponential explosion is what restricts us from simulating such systems.

A qubit however can also be seen as a probability distribution, with the two basis vector being the possible outcomes. This restricts α and β such that $|\alpha|^2 + |\beta|^2 = 1$. This allows us to rewrite an arbitrary qubit as $|\psi\rangle = \cos(\frac{\theta}{2})|0\rangle + e^{i\phi}\sin(\frac{\theta}{2})|1\rangle$, which places the qubit as a point on a Bloch Sphere. From this, we can see that the two angles, θ and ϕ are sufficient to represent the information held by a qubit.

We would like to examine a quantum system from the perspective of these angles. In other words, this can be seen as moving from cartesian to polar coordinates. The major benefit of this is that it would allow us to exploit symmetries, in order to reduce the amount of information needed to represent $n-$qubit systems, and therefore the amount of operations needed to transorm it.