NISQ devices offer opportunities to test the principles of quantum computing, but unstable devices undermine the reproducibility of NISQ results. Here we quantify the stability of characteristic performance metrics based on the DiVincenzo requirements [1] for physical implementation of quantum computing: Initialization Fidelity ($F_I$), Gate Fidelity ($F_G$), Duty Cycle ($\tau$), and Register Addressability ($F_A$). For example, for a 2-qubit circuit with a Hadamard gate on each:

$$H_m \leq \sqrt{1 - \exp\left[\frac{\delta^2(1 - \delta^2)}{2\sigma^2}\right]}$$

where,

- $H_m$ = Hellinger Distance between fidelity distributions
- $\sigma$ = characteristic width of the noise and
- $\delta$ = user-defined reproducibility bound on the output distribution

1. **Intra-day Stability: Initialization Fidelity ($F_I$)**

2. **Inter-Device Stability: Gate Fidelity**

3. **Temporal Stability: Duty Cycle**

4. **Spatial Stability: Addressability**

**Figure 1:** $F_I$ quantifies the accuracy of target state preparation.

**Figure 2:** Gate fidelity $F_G = 1 - \epsilon_G$ measures the accuracy of a quantum operation.

**Figure 3:** The duty cycle $\tau = T_C/T_G$ is defined as the ratio of register coherence time to gate duration.

**Figure 4:** Addressability $F_A = 1 - 2I(Q_0; Q_1)H(Q_0) + H(Q_1)$ quantifies the ability to measure register elements individually.

**References**
