

**Erratum: Optimal control theory for unitary transformations
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We regret to report a few mistakes in Sec. III of our article.
Equation (30) should be

$$\boldsymbol{\gamma}_k(T) = c_k \boldsymbol{\alpha}_{fk}(T) - d_k \boldsymbol{\beta}_{fk}(T), \quad \boldsymbol{\delta}_k(T) = d_k \boldsymbol{\alpha}_{fk}(T) + c_k \boldsymbol{\beta}_{fk}(T). \quad (30)$$

Consequently $\tilde{\boldsymbol{\gamma}}_k \equiv (c_k \boldsymbol{\gamma}_k + d_k \boldsymbol{\delta}_k) / (c_k^2 + d_k^2)$, $\tilde{\boldsymbol{\delta}}_k \equiv (c_k \boldsymbol{\delta}_k - d_k \boldsymbol{\gamma}_k) / (c_k^2 + d_k^2)$, and Eqs. (32) and (37) should be

$$\frac{\partial g}{\partial \boldsymbol{\epsilon}}(\boldsymbol{\epsilon}^{(1)}) = \sum_{k=1}^N [c_k \tilde{\boldsymbol{\gamma}}_k(t) - d_k \tilde{\boldsymbol{\delta}}_k(t)] \cdot \frac{\partial \mathbf{f}_\alpha}{\partial \boldsymbol{\epsilon}}(t, \boldsymbol{\alpha}_k^{(1)}, \boldsymbol{\beta}_k^{(1)}, \boldsymbol{\epsilon}^{(1)}) + \sum_{k=1}^N [d_k \tilde{\boldsymbol{\gamma}}_k(t) + c_k \tilde{\boldsymbol{\delta}}_k(t)] \cdot \frac{\partial \mathbf{f}_\beta}{\partial \boldsymbol{\epsilon}}(t, \boldsymbol{\alpha}_k^{(1)}, \boldsymbol{\beta}_k^{(1)}, \boldsymbol{\epsilon}^{(1)}), \quad (32)$$

$$\boldsymbol{\epsilon}^{(1)}(t) = \tilde{\boldsymbol{\epsilon}}(t) + \frac{1}{2\lambda(t)} \sum_{k=1}^N [c_k \tilde{\boldsymbol{\gamma}}_k(t) - d_k \tilde{\boldsymbol{\delta}}_k(t)] \cdot \frac{\partial \mathbf{f}_\alpha}{\partial \boldsymbol{\epsilon}}(t, \boldsymbol{\alpha}_k^{(1)}, \boldsymbol{\beta}_k^{(1)}, \boldsymbol{\epsilon}^{(1)}) + \sum_{k=1}^N [d_k \tilde{\boldsymbol{\gamma}}_k(t) + c_k \tilde{\boldsymbol{\delta}}_k(t)] \cdot \frac{\partial \mathbf{f}_\beta}{\partial \boldsymbol{\epsilon}}(t, \boldsymbol{\alpha}_k^{(1)}, \boldsymbol{\beta}_k^{(1)}, \boldsymbol{\epsilon}^{(1)}). \quad (37)$$

Some typographical errors appear in Eqs. (41) and (43). They should read

$$\Delta_{1,sm} = \left| \sum_{n=1}^N \langle n | [\hat{\mathbf{U}}^\dagger(T, 0; \boldsymbol{\epsilon}^{(0)}) - \hat{\mathbf{U}}^\dagger(T, 0; \boldsymbol{\epsilon}^{(1)})] \hat{\mathbf{O}} | n \rangle \right|^2, \quad (41)$$

$$\Delta_{1,ss} = \sum_{l=1}^N |\langle l | [\hat{\mathbf{U}}^\dagger(T, 0; \boldsymbol{\epsilon}^{(0)}) - \hat{\mathbf{U}}^\dagger(T, 0; \boldsymbol{\epsilon}^{(1)})] \hat{\mathbf{O}} | l \rangle|^2. \quad (43)$$

These mistakes and typographical errors did not affect the contents, results, and conclusions of the paper.