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Real-time dynamics of the Schwinger model via variational quantum algorithms

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In this study, we investigate the real-time dynamics in the $(1 + 1)d$ $U(1)$ gauge theory called the Schwinger model via variational quantum algorithms. Specifically, we simulate the quench dynamics in the presence of the external electric field.

We first prepare the ground state in the absence of the external field using variational quantum eigensolver (VQE) and then perform the real-time simulation in the presence of the external field starting from the VQE results via variational quantum simulation (VQS). We use the same ansatz in both VQE and VQS which enables us to reduce the overall circuit depth.

We test our method using a classical simulator and confirm that our simulation results agree well with the exact results.

Topical area

Quantum Computing and Quantum Information

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