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Quench dynamics in the Sine-Gordon model - Loschmidt Echo and work distribution

The Sine-Gordon Hamiltonian is ubiquitous in low-dimensional physics, with applications that range from cold atom systems and strongly correlated systems to quantum impurity systems. We study here its non-equilibrium dynamics using the quantum quench protocol where the system is allowed to time evolve under the Hamiltonian from initial states that we choose as the Mott type ground state or highest excited state of the model with large potential barriers and which are lowered under the quench. Using the Bethe Ansatz we calculate exactly the Loschmidt amplitude, the fidelity and work distribution characterizing these quenches for different values of the interaction strength. Some universal features are noted as well as an interesting duality relating quenches in different parameter regimes of the model.