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Quantum information processing with a minimal control PETER PEMBERTON-ROSS, SONIA SCHIRMER, DAMTP, University of Cambridge, IVAN PULLEN — Various physical and practical constraints limit the amount and type of control we have in quantum information processing systems, leading to complicated or unreliable implementations. To try and circumvent these problems, we take the most restricted candidate systems where only a single energy transition can be controlled by a piecewise-constant field, and show that even this is sufficient for efficient execution of a range of useful QIP tasks. We show that it is in principle possible to achieve global control with a single, simple, fixed, local actuator, and show how such minimal control could significantly improve information processing in terms of speed, fidelity and transfer efficiency. The scheme presented has a natural application to spin-chain systems, where only one interaction between two spins can be controlled, and the effects of the position of the controller in the 'quantum wire' and the system's symmetries are explored. It may also be relevant for gate-controlled solid-state systems where it is desirable or necessary to limit the number of control electrodes due to the constraints of size, decoherence and cross-talk, and where complex temporal variation of the control voltages is difficult.

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