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Shift register in a SQUID architecture with untunable couplings¹ PREETHIKA GAGNEBIN, STEVEN SKINNER, Department of Electrical and Computer Engineering, Wichita State University, ELIZABETH BEHRMAN, Department of Physics, Wichita State University, JAMES STECK, Department of Aerospace Engineering, Wichita State University — A scheme to implement a qubit shift register in a one-dimensional series of superconducting quantum interference devices (SQUIDs), using a sequence of pulsed biases, is described. Each SQUID is coupled to its neighbors through an untunable coupling parameter. The only variable parameter of the system is the bias on each SQUID, which is pulsed low during a shift operation. Our design requires only two bias control signals for any size of shift register, with an additional one on the output qubit to shift out the data. The shift register operation is realized by copying the state of one qubit onto another, in the direction of the shift, during the bias pulse. As the no-cloning theorem prohibits the cloning of an unknown arbitrary quantum state, this device works as a classical shift register or, in other words, a binary wire. We show here how to find the time duration of the bias pulse and the minimum value of the bias during the pulse given the fixed physical parameters of the system.

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