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## Physical Information Theoretic Bounds on Energy Costs for Error Correction

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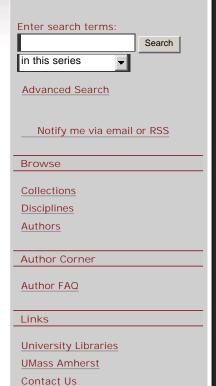
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## Abstract

With diminishing returns in performance with scaling of traditional transistor devices, there is a growing need to understand and improve potential replacements technologies. Sufficient reliability has not been established in these devices and additional redundancy through use of fault tolerance and error correction codes are necessary. There is a price to pay in terms of energy and area, with this additional redundancy. It is of utmost importance to determine this energy cost and relate it to the increased reliability offered by the use of error correction codes. In this thesis, we have determined the lower bound for energy dissipation associated with error correction using a linear (n,k) block code. The bound obtained is implementation independent and is derived from fundamental considerations and it allows for quantum effects in the channel and decoder. We have also developed information theoretic efficacy measures that can quantify the performance of the error correction and their



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