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Jericho Park Road, Bowie, MD 20715. *Quantum Walks with Decoherence on the*
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For a discrete time quantum random walk (QRW) on the N -cycle, allowing for decoherence on the coin, we derive a number of new results, including an explicit formula for the position probability distribution. For a QRW of this type, we show that the mixing behavior tends, in the long-run, to a uniform distribution, regardless of the initial state of the system and irrespective of the parity of the number of nodes N . Our results confirm the observations of previous authors who arrived at similar conclusions through extensive numerical simulations. In particular, we infer that the mixing time $\overline{M}(\epsilon)$ for the time-averaged probability distribution is of order $O(N^2/\epsilon)$. (Received September 19, 2009)