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Suitable bases for discrete-time quantum walks.

The analysis of a physical problem simplifies considerably when one uses a suitable coordinate system. We apply this idea to the discrete-time quantum walks and discuss how does the description of the quantum walk simplify when the initial coin state is decomposed in a suitable basis. In particular, the suitable basis allows us to express the limit distributions in a much more convenient form. Consequently, various interesting features which are hidden in the standard basis description are easily identified. The vectors of the suitable basis are selected from states which result in non-generic behaviour of the quantum walk. We show that for the familiar Hadamard walk and the three-state Grover walk the suitable basis can be formed simply from the eigenvectors of the coin operator. On the other hand, for quantum walks with coins given by $2j + 1$ -dimensional Wigner rotation matrices the construction of the suitable basis is more involved, however, we find a recipe to select the suitable basis for arbitrary dimension. (Received September 14, 2015)