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Quantum walks on join graphs

Let M be the adjacency or Laplacian matrix of a graph X. A quantum walk on X is determined by the unitary matrix $U(t) = \exp(itM)$, whereby $|U(t)_{u,v}|^2$ is interpreted as the probability that a quantum state at vertex u is found at vertex v at time t. In particular, if $|U(\tau)_{u,v}|^2 = 1$, then we say that perfect state transfer occurs between u and v at time τ.

The join $X \vee Y$ of two graphs X and Y is the graph obtained by joining each vertex of X to each vertex of Y. In this talk, we discuss the properties of quantum walks on join graphs, with emphasis on perfect state transfer. Throughout, we rely on the spectral properties of join graphs relative to the adjacency and Laplacian matrix.