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Achieving strong state transfer using a bounded potential

Considering each particle of an n-qubit system as a vertex, we can describe quantum transport phenomena using graphs. The probability of transferring the state of node u to node v at time t is given by $p(t) = \langle u|e^{itH}|v\rangle^2$. Here the Hamiltonian, H, of this system corresponds to the adjacency matrix and energy potential.

Assume the graph has an involution T and the potential takes value Q on nodes u and $v = Tu$ and 0 elsewhere. In this setting Lin, Lippner, and Yau have shown that there is asymptotic state transfer, that is, $\sup_t p(t) \to 1$ as Q goes to infinity. Kirkland and van Bommel recently proved a strong quantitative version of this result when the graph is a path with endpoints u and v.

In this talk, I will discuss a generalization of the Kirkland - van Bommel bound to arbitrary graphs with an involution. By studying approximate eigenvectors of the Hamiltonian, we get quantitative bounds on the potential that guarantees asymptotic state transfer. Remarkably, these bounds depend only on the maximum degree of the graph and not its size.

Joint work with Gabor Lippner.