RADHAKRISHNAN BALU, US Army Research Lab
Group Theoretic Treatment of Quantum Walks

We use representation theory of groups to classify coin operators of different quantum walks and provide an unified framework. We formulate quantum walks on Plancherel decompositions that are guaranteed by Peter-Weyl theorem for compact groups satisfying axiom of second countability. We build a quantum probability space and derive standard quantum walks such as Hadamard walk, Pauli operators based quantum Bernoulli processes, and walks on angular momentum space within this framework. We also outline their asymptotic behavior for different initial states using functional central limit theorems on Fock spaces, toy for time-discrete and true for time-continuous walks respectively, in terms of conjugate Brownian motions and Poisson processes. A step of the walker described in terms of annihilation and creation operators on Fock spaces provides insights into the relation between discrete and continuous time quantum walks.