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Title: Eigenfunction estimation for the neutron transport equation

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Abstract:

The neutron transport equation models the evolution of particle populations in fissile media and plays a central role in nuclear engineering. Its solution can be interpreted probabilistically as the mean behaviour (expectation semigroup) of a neutron branching process, where individual neutrons move, scatter, and produce fission events randomly. The long-term behaviour of this semigroup admits a Perron-Frobenius decomposition into a leading eigenvalue, an associated eigenfunction, and an eigenmeasure. Estimating this eigentriple is crucial for understanding criticality and particle distribution in the system. While recent Monte Carlo methods provide efficient estimators for the eigenvalue and eigenmeasure, estimating the eigenfunction remains computationally challenging, as it typically requires simulations initialized across the entire phase space. In this seminar, we propose a new method to estimate the eigenfunction based on a backward process for the particles.