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Stochastic perturbations and invariant measures of position dependent random maps via Fourier approximations

Let $T = \{\tau_1(x), \tau_2(x), \ldots, \tau_K(x); p_1(x), p_2(x), \ldots, p_K(x)\}$ be a position dependent random map which posses a unique absolutely continuous invariant measure $\hat{\mu}$ with probability density function $\hat{f}$. We consider a family $\{T_N\}_{N\geq 1}$ of stochastic perturbations T_N of the random map T. Each T_N is a Markov process with the transition density $\sum_{k=1}^{K} p_k(x) q^N(\tau_k(x), .)$, where $q^N(x, .)$ is a doubly stochastic periodic and separable kernel. Using Fourier approximation, we construct a finite dimensional approximation P_N to a perturbed Perron-Frobenius operator. Let f_N^* be a fixed point of P_N. We show that $\{f_N^*\}$ converge in L^1 to $\hat{f}$.