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Reversible Markov processes on general spaces: spatial birth-death and queueing

This study describes the stationary distributions of spatial birth-death and queueing processes that represent systems in which discrete units (customers, particles) move about in an Euclidean or partially ordered space where they are processed. These are reversible Markov jump process with uncountable state spaces (sets of “finite” counting measures). Reversible Markov processes on countable state spaces, introduced by Kolmogorov, have the exceptional property that their stationary distributions have a canonical form: a simple ratio of products of transition rates. We present an analogue of this result for uncountable state spaces. This involves representing two-way communication by certain Radon-Nikodym derivatives for measures on product spaces. Included is a Kolmogorov criterion that establishes the reversibility in the same spirit as one studies $[\psi]$-irreducible Markov jump processes (Meyn and Tweedie (1993). Stationary Markov Chains and Stochastic Stability). Related references for “infinite” birth-death processes are: N. Lopes Garcia, (1995). *Birth and death processes as projections of higher-dimensional Poisson processes*. Adv. in Appl. Probab., E. Glotzl, (1981). *Time reversible and Gibbsian point processes. I. Markovian spatial birth and death processes on a general phase space*. Math. Nachr.