

Strong Approximations in Queueing Theory

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This paper discusses some of the merits of the strong approximation ideas in developing diffusion approximations for queueing systems. Letting ρ be the utilization of the server, it is well known that as the queue is sent into heavy-traffic (i.e. $\rho \rightarrow 1$), the system can be approximated by a diffusion process on spatial scales of order $(1-\rho)^{-1}$ and time scales of order $(1-\rho)^{-2}$. In this paper, we show how strong approximation methods permit one to validate the applicability of the diffusion approximation to the queue over other temporal and spatial scales. In addition, some pedagogical advantages of the strong approximation approach are discussed, and two open problems for the strong approximation community are described.