

## A Diffusion Approximation with a GI/GI/1 Queue with Balking or Reneging

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- [WardG05.pdf](#)

Consider a single-server queue with a renewal arrival process and generally distributed processing times in which each customer independently reneges if service has not begun within a generally distributed amount of time. We establish that both the workload and queue-length processes in this system can be approximated by a regulated Ornstein-Uhlenbeck (ROU) process when the arrival rate is close to the processing rate and reneging times are large. We further show that a ROU process also approximates the queue-length process, under the same parameter assumptions, in a balking model. Our balking model assumes the queue-length is observable to arriving customers, and that each customer balks if his or her conditional expected waiting time is too large.