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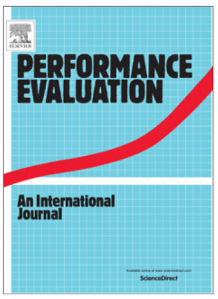

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Alternating Server with Non-Zero Switch-Over Times and Opposite-Queue Threshold-Based Switching Policy

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Abstract

A single server alternates between two Markovian queues with *non-zero* switch-over times. The server's switching instants are determined by the number of customers accumulated at the *unattended* queue. Specifically, when queue i $(i = 1, 2)$ is attended and the number of customers in queue j $(j = 1, 2; j \neq i)$ reaches a threshold, the server starts an exponentially distributed switch-over time to queue j, unless the number of customers in queue i is equal to or above queue i's threshold. However, if during a switch-over period from queue i to queue j the former reaches its threshold, the switch-over is **aborted**, and the server immediately returns to queue i and continues to serve the customers there. We analyze the system mainly via Matrix Geometric (MG) methods while deriving explicitly the rate matrix R, and thus eliminating the need for successive substitutions. We further reveal connections between the entries of R and the roots of polynomials related to the Probability Generating Functions (PGFs) of the system states. Expressions for the system's performance measures are obtained (e.g. mean queue size and mean sojourn time in queue 1, PGF and mean of the queue size in queue 2, as well as the Laplace Stieltjes transform and mean of the sojourn time in queue 2). Numerical results are presented and the effects of the various parameters, as well as the switch-over times, on the performance measures are examined. Seemingly counter-intuitive phenomena are discussed. Finally, various extreme cases are investigated.

Keywords: Alternating server, Non-zero switch-over times, Opposite-queue threshold policy, Derivation of the rate matrix R

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