

# EXPLICIT SOLUTIONS AND OTHER PROPERTIES OF SUCCESSIVELY LUMPABLE QUASI SKIP FREE PROCESSES

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We consider the class of Quasi-skip-free processes (QSF), a generalization of the quasi-birth-and-death processes. Their probability state transition law does not permit transitions to a state in a level two or more units away from the current states level in one direction. We use a simple condition under which a QSF is successively lumpable (SL-QSF) and the steady state distribution can be calculated explicitly and rapidly. These processes have applications in many areas of applied probability including queueing theory, reliability and the theory of branching processes.

We use this successive lumpability property to derive explicit solutions and bounds for the steady state probabilities of general state space SL-QSFs, and to obtain a number of simplified derivations for results that are much more difficult to establish otherwise. Further, we discuss a procedure to decompose QSFs into separate SL-QSFs and we use the method of successive lumping to calculate discounted rewards in a QSF with a fixed policy.