Exponential splitting and extracting exponential component in distribution method for regenerative simulation of queueing network

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Regenerative modeling is actively used for queuing networks and queuing systems. The idea behind the regenerative modeling method is to divide the values of the process into regeneration cycles that are independent of each other. The start moments of a new regeneration cycle form a nested recovery process and determine when the process reaches a certain state in which its behavior is independent of its history. An example of such a moment could be the moment when the network is emptied. However, for service networks whose input flow is a superposition of independent input flows, classical regenerative modeling is not applicable due to the dependence of the intervals between arrivals in the mixed input process. There are two methods that can be used to solve this problem: the exponential splitting method and the method of extracting exponential component in distribution. The exponential splitting method involves replacing the density of the original random variable with a mixture of densities, one of which is the density of the exponential distribution. In the case of exponential decomposition, the original random variable is represented as a sum of independent random variables, one of which has an exponential distribution. In this article, these methods are applied to the input stream of a queueing network, which is a superposition of Pareto processes. The main objective of the article is to determine which of the two methods demonstrate better results.