Weak regeneration in modeling of queueing processes

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Abstract

A survey of recent results on weak regeneration in queueing processes is given in which an embedded process of regeneration points is renewal, but unlike classical regeneration, a dependence between adjacent cycles is allowed. We develop a unified two-step approach to stability analysis based on a characterization of the limit behavior of the forward renewal time. This employs an extended construction (initially proposed by S. Foss and V. Kalashnikov), which is widely used to transform an original one-dependent regenerative process into weakly regenerative one. It is shown that the approach simplifies stability analysis of many queuing processes. (The tightness of the queueing processes plays an important role in the proofs.) In particular, we consider both well-known classical queues and multi-server queues with regenerative input and non-identical servers. Included is a stability analysis of a feed-forward network with regenerative input and non-identical servers in the nodes.

Key words and phrases: Renewal process, regenerative input, positive recurrence, stability analysis, weak regeneration, multi-server queue, non-identical servers, feed-forward queueing network, long-range dependence

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