Markov chain approach for stability analysis of two class retrial queuing models

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We consider an arbitrary two class single-server retrial model fed by Poisson input. If incoming customer meets the server busy, it joins to the infinite capacity buffer of corresponding class (so called orbit) and then tries to capture the server after exponentially distributed retrial time. Note that the system obeys to constant retrial rate policy, thus the intensities of orbit streams do not depend on the number of customers on it. The model is stable if both orbit-queue size processes are stochastically bounded.

An important condition for the systems considered in present research is that all governing distributions, except probably service times, are assumed to be exponential. This allows as to construct two-dimensional Markov Chain (MC) associated with number of customers at each orbit just after departure instants. Next we apply the ergodicity criterion presented in the book Theory of Countable Markov Chains [Fayolle, G., Malyshev, V., Menshikov, M. (1995)] to obtain the stability condition. Note that such a method is based on negative drift conditions for both components of MC and its combinations. The ergodicity condition involves free alternative cases and we show that such cases are joined into the system of two inequalities which indeed define the stability criterion for the retrial model under consideration.

Ricently his method was successfully applied to the simple two-class retrial model, retrial model with balking and more complicated retrial model with unreliable server, when a new arrival first joins the corresponding orbit and after that tries to capture the server.

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