Srikant, Rayadurgam; **Whitt, Ward**

Variance reduction in simulations of loss models. (English) Zbl 1014.90011

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Summary: We propose a new estimator of steady-state blocking probabilities for simulations of stochastic loss models that can be much more efficient than the natural estimator (ratio of losses to arrivals). The proposed estimator is a convex combination of the natural estimator and an indirect estimator based on the average number of customers in service, obtained from Little's law ($L = \lambda W$). It exploits the known offered load (product of the arrival rate and the mean service time). The variance reduction is dramatic when the blocking probability is high and the service times are highly variable. The advantage of the combination estimator in this regime is partly due to the indirect estimator, which itself is much more efficient than the natural estimator in this regime, and partly due to strong correlation (most often negative) between the natural and indirect estimators. In general, when the variances of two component estimators are very different, the variance reduction from the optimal convex combination is about $1-\rho^2$, where ρ is the correlation between the component estimators. For loss models, the variances of the natural and indirect estimators are very different under both light and heavy loads. The combination estimator is effective for estimating multiple blocking probabilities in loss networks with multiple traffic classes, some of which are in normal loading while others are in light and heavy loading, because the combination estimator does at least as well as either component estimator, and it provides improvement as well.

MSC:

90B15 Stochastic network models in operations research
90C15 Stochastic programming

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