# AN ALGORITHM TO COMPUTE BLOCKING PROBABILITIES IN MULTI-RATE MULTI-CLASS MULTI-RESOURCE LOSS MODELS

by

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*ABSTRACT*

We describe a new algorithm for calculating blocking probabilities and other steady-state characteristics in a large class of product-form loss models, based on numerical inversion of the generating functions of the normalization constants (or partition functions). This algorithm provides the basis for computer-aided performance analysis of communication networks and computer systems. The models include loss networks (or circuit-switched communication networks) and a class of resource-sharing models. There can be multiple classes of requests for multiple resources. The requests can be for multiple units in each resource (the multi-rate case, e.g., several circuits on a trunk). There can be finite-source inputs as well as Poisson arrivals. There can be upper-limit and guaranteed-minimum sharing policies as well as the standard complete-sharing policy. If all the requirements of a request cannot be met upon arrival, then the request is blocked and lost. In a previous work we introduced the numerical inversion approach to product-form models and developed a full algorithm for a class of closed queueing networks. To treat the loss models here, we derive the generating functions of the normalization constants and develop a new scaling algorithm especially tailored to the loss models. In general, the computational complexity grows exponentially in the number of resources, but the computation can often be reduced dramatically by exploiting conditional decomposition based on special structure and by appropriately truncating large finite sums. We show that our numerical inversion algorithm is effective by applying it to several examples. The algorithm is shown to agree with other algorithms where applicable, and to apply to some models not previously considered.

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