Performance and Optimization of Finite Closed Queueing Network Models

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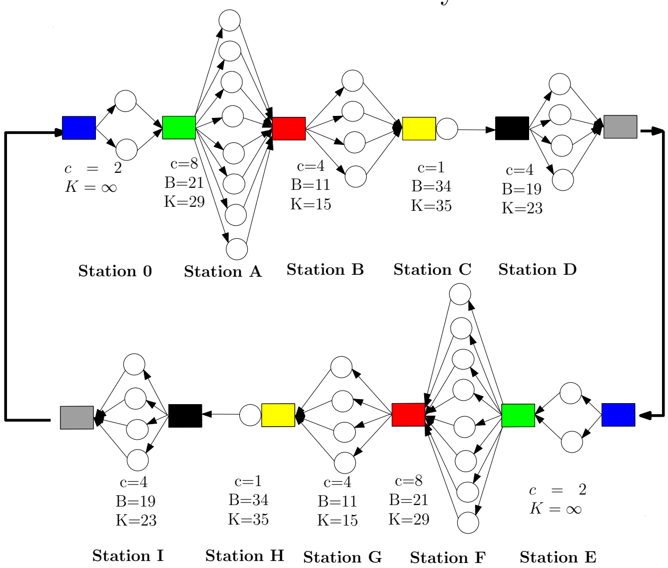
Closed finite queueing networks with finite buffers, and a fixed population circulating through the network are applicable to many different manufacturing and service system settings. A novel queue decomposition approach using state dependent queues to capture the buffer of finite $M/M/c/K$ queues is shown to be a viable approach for modelling these systems. Each workstation is replaced with a coupled state dependent queue plus an $M/M/c/K$ queue. An extended mean value analysis (MVA) algorithm is employed to demonstrate the integration of the state dependent queues for the finite buffers in the network. Under certain restrictions concerning the network population, finite queueing networks with the state dependent queues acting as buffers should have a product form distribution. Several different closed series (*i.e.* cyclic), merge, and split topological systems of finite queues are analyzed and presented. The incorporation of material handling and transportation networks in finite buffer closed queueing networks is also studied along with the optimization of the servers and finite buffers within the systems.



Short Bio

Professor Smith graduated with a B.Arch and M.Arch from the University of California at Berkeley and a Ph.D. in Mechanical and Industrial Engineering from the University of Illinois in Champaign-Urbana. Professor Smith conducts research on topological network design, stochastic network design and analysis, and facility layout and location problems. In particular, he is doing research on Steiner minimal trees in 3d, applications of Steiner Trees to Minimum Energy Configurations (MEC's) and protein modelling. He is also working on state dependent queueing network analysis and finite buffer queueing network models, quadratic assignment and set packing problems. Applications include the design and layout of manufacturing plants, health care facilities, and many other systems. One of the unique modelling tools developed in our research is concerned with dynamic traffic flow models using queueing theory and queueing networks. He has published in many of the operations research journals concerned with optimization and stochastic processes.