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Model-Based Performance Evaluation of A Multi-User-Shared-Service-Resource Network
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We propose a discrete-time queueing network model for a multi-user shared-service-resource network, with both full-duplex and half-duplex transmission, in which the destinations of consecutive packets may be correlated. We show that for input queues of all users under saturation, the steady-state probabilities have an approximate product-form solution.

We also find an efficient protocol for the half-duplex transmission channels. And a comparison of performance between unidirectional and bidirectional transmission is also presented.
Methodology

- Queueing Model

- Mathematical Description

Getting the steady state probability and performance parameters using Buzen’s Algorithm.

\[
\tau_i = \frac{G_M(N-1)}{G_M(N)}
\]

\[
t_i = \frac{\bar{n}_i}{\tau_i} = \frac{\sum_{k=1}^{N} x_i^k}{x_i}
\]
Results & Extensions

**Results & Conclusions**
- Full Duplex Transmission
  Error of the approximate formula results is less than 1%
- Half Duplex Transmission
  Error of the approximate formula results is less than 2%
- Bidirectional transmission model outperforms unidirectional transmission model

**Extensions & Discussions**
- Find the theoretical optimum scheme for the half-duplex transmission under the bidirectional transmission model
- Extend the model to more general case e.g. instead of using FCFS, consider LCFS or ROS
- Use non-symmetrical transition probability matrix