Optimal Packet Length for Throughput Maximization in Correlated Multi-User Channels

Summary:

Optimal packet data size is derived for throughput maximization of the system. For this size, the packet error rate (PER), level crossing rate (LCR), and the average outage duration (AOD) are derived.

Multi-user communications based on second-order channel statistics is less studied in literature. In [1], LCR and AOD are derived for a point-to-point system subject to frequency-selective fading where the receiver deploy maximal-ratio combining (MRC).

In [2], again only LCR and AOD are derived for a receiver with a single antenna, however, the system is a multi-user system subject to flat Rayleigh fading.

In our work, we consider multi-user system with unequal mobility speeds for every transmitter with unequal transmitting powers having single antenna each, and multiple antennas at the receiver which deploys MRC. We derive an approximate LCR expression for the signal-to-interference ratio (SIR) of the system under consideration. Then we model the system using a two-state Markov chain model utilizing the derived LCR expression to derive an expression for the packet error rate (PER).

Many works have been done in literature on ARQ-based systems due to their practical importance. Different ARQ schemes, mainly stop and wait (SW) ARQ, go-back-N (GBN) ARQ and selective-repeat (SR) ARQ, have been analyzed for different AWGN and fading channels.

In [3], the authors consider a point-to-point system and evaluate the throughput without data packet length optimization.

In [4], again a point-to-point system is studied under slow Rayleigh flat fading and an expression for the optimum data packet length maximizing the throughput was derived.

In our work, we derive the optimum data packet length for the multi-user system described above when deploying SW-ARQ scheme, via utilizing the Finite State Markov Chain (FSMC) Model developed throughout the paper. We express the optimum data packet length in terms of the system's parameters and discuss their effects on it.

References

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