AR-based quadratic modeling for GOP MPEG-encoded video traffic in ATM networks

A. A. Alheraish and S. A. Alshebeili
Department of Electrical Engineering, King Saud University, P.O. Box 800, King Khalid Road, Riyadh 11421, Saudi Arabia
Received 9 December 2002; revised 14 July 2003; accepted 6 August 2003. Available online 4 September 2003.

Abstract

Statistical analysis and performance modeling of compressed video traffic streams are efficient tools to estimate network resources and to predict network behavior under various conditions. Among current video traffic models, Autoregressive (AR) processes have been extensively used as good representation of variable bit rate video services, due basically to their simplicity and ease of computation. Recently, an elegant approach to the modeling of teleconferencing video has been proposed by Zhang in IEEE Trans. Circuits Syst. Video Technol. 9 (1999) p. 1130. This approach decomposes the traffic data into a linear combination of a number of chi-square sequences, each of which is obtained by passing a Gaussian AR process through a simple non-linearity. In this article, we first show that the model presented by Zhang is a special case of the general form of models represented by quadratic filters that are widely used in modern digital signal processing. Second, we extend Zhang's approach to model MPEG video traffic; an important full motion video source that exhibits dynamic and complex pattern. Specifically, we propose modeling MPEG video at GOP layer in ATM packet switching networks. This layer has an important feature in that it reflects the behavior of video scene activities. Finally, by using a wide variety of real MPEG video sequences, we experimentally demonstrate that the proposed GOP-based model approximates the real video traffic extremely well in terms of first and second order statistics as well as queuing performance.

Author Keywords: Non-linear model; AR; Video traffic modeling; ATM

Corresponding author. Tel.: +96614676806; fax: +96614676757