

Chapter 8

Discussions

Wireless ATM technologies provide innovative solutions for constructing a generic broadband network to ensure wireless QoS and mobility management. Due to the multipath propagation and interference properties, the wireless transmission is radically different from the properties in an ATM network based on point-to-point fiber links. In order to mitigate the effect of wireless channel errors before cells are sent to the ATM layer, the DLC layer with flexible error control is required. This thesis discusses four service-class-specific error control schemes (PC-UEP, PT-UEP, PC-HA, and PT-HA) for wireless ATM networks in order to achieve better CLR and throughput performance by available implementations.

Chapter 2 describes some wireless ATM systems, which are mainly considered as accesses to ATM networks. Depending on what kind of ATM network is to be accessed, different aspects of wireless networking need to be addressed. Error control is quite complicated for the multimedia communications in wireless channel, due to various conflicting requirements. Finding an engineering solution between ARQ and FEC to satisfy all QoS requirements is difficult. This thesis tries to solve it using the FEC and HARQ schemes.

Chapter 3 shows two theorems about the algebraic properties of PCCs. Theorem 1 depicts the generator polynomial matrix $J(D)$ of $R = \frac{l}{nt}$ CCs from a $R = \frac{1}{n}$ CC. Then, the generator polynomial matrix $Q(D)$ of $R = \frac{l}{nt-m}$ PCCs can be derived by being punctured m columns from $J(D)$ in terms of a perforation matrix. Theorem 2 depicts the constraint length of the high rate $\frac{l}{nt-m}$ CC punctured from a low rate $\frac{1}{n}$ CC. By virtue of these properties, the puncturing realizations of the known good nonsystematic high rate $\frac{l}{n}$ CCs from nonsystematic $R = \frac{1}{n}$ CCs and the known good systematic high rate $\frac{n-1}{n}$ CCs from $R = \frac{1}{2}$ systematic CCs are given.

In Chapters 4 and 5, the FEC schemes are proposed using the RCPC and RCPT codes, respectively. Since the importance of the information bits is considered different between the header and various payloads, the FEC schemes with two level UEP are introduced to satisfy a certain QoS required by the type of services for worst channel conditions.

In general, FEC schemes are applied to the time-sensitive transmission, whose main disadvantage is the constant burning of the extra bandwidth, even when there are no errors. Therefore, some applications that are time-insensitive need to be transmitted with the HARQ scheme, which has the potential to provide a variable overhead. Chapters 6 and 7 describe two kinds of HARQ schemes, which apply the RCPC and RCPT codes, respectively. Since no received information is discarded, our scheme concludes to increase the throughput of ARQ schemes from an information theoretic standpoint.

It should be said that though the UEP schemes are more complicated than the EEP schemes, and the HARQ schemes are more complicated than the standard ARQ schemes, the hardware complexity of the proposed schemes is only slightly higher. Because the perforation and interleaver matrices of the RCPC and RCPT codes are programmable so as to require the same coding hardware alone, i.e., one encoder and one decoder circuits.

For future research topics, the following aspects need studying :

- Seeking out more effective RCPT codes.

This thesis just utilizes some general RCPT codes to show their better performance. Applying some better RSC component codes [68] and interleavers[60][69] maybe improve the performance of RCPT codes further more. Then, the better error control schemes for wireless ATM can be obtained.

- Performing an more efficient evaluation of the DLC scheme. Perhaps, the finite state channel model is required for the time varying error behavior of the fading channel [22].
- Applying UEP technique to the HARQ scheme. In this way, many new schemes may be produced. For example, the header and payload can apply their own HARQ schemes respectively.
- Calculating the call blocking probability of each FEC schemes under given traffic load.
- Analyzing the delay distribution under the condition that HARQ is employed for cell retransmissions.