

Abstract

Synchronization error correction has been under discussion since the early development of coding theory. In this research report a novel coding system based on the previous done work on path-pruned convolutional codes and extended prefix synchronization codes is presented. This new coding scheme is capable of correcting insertion, deletion and synchronization errors. A codebook has been constructed that contains synchronization patterns made up of a constraint part (marker sequence) and an unconstraint part based on the concept of extended prefix codes. One of these synchronization error patterns are padded in front of each frame. This process is done by mapping information bit to a corresponding bit sequence using a mapping table. The mapping table is constructed by using path-pruning process. An original rate convolutional code is first punctured using a desired puncturing matrix to make enough paths available at each state of the trellis. The desired paths are then pruned and matches to the extended prefix codebook constructed. The path pruning process consists of a feedback mapper attached in front of the original rate parent convolutional encoder with puncturing. The state of the convolutional encoder is fed back to the mapper which maps first information bit of the frame into a multi-bit sequence that is fed into the convolutional encoder with puncturing and thus produces one of the synchronization patterns contained within the codebook constructed. The remaining bits of the frame are encoded normally using convolutional encoding with a puncturing process only. This process is repeated periodically depending on the condition of the channel.

Simulations were performed to evaluate the ability of new system to resynchronize and correct insertion/deletion and synchronization errors at the receiver, from which favorable results were obtained. Simulations were performed with different synchronization pattern (extended prefix code word) lengths, different constraint lengths of the parent encoder and using Reed-Solomon codes as outer code in concatenation with new coding system.

A complete concatenated coding system is thus demonstrated and studied that resynchronizes and corrects insertion, deletion and substitution errors.