ABSTRACT

The availability of wireless technology has revolutionized the way of communications is done in our world today. Cellular and Satellite technology make it possible for people to be connected to the rest of the World from anywhere and provide a variety of different services including multimedia communication. With this increased availability comes increased dependence on the underlying systems to transmit information both quickly and accurately with low bit error rates.

However, due to the limitation of the battery life of wireless devices, transmitted power should remain as low as possible. Low power makes the system more susceptible to noise and interference. Error-correction coding (ECC) is used to reduce the probability of channel effects corrupting the information being transmitted. A new type of coding, called Turbo coding, has reached a great interest in the last years because of large coding gains and reasonable computation complexity.

Turbo code has been widely used in deep space communications with a lot of success, but recently Turbo code has been investigated for tactical and commercial multimedia applications. It can achieve a level of performance that comes closer to theoretical bounds than more coding systems. Two key innovations in Turbo coding are parallel concatenated encoding and iterative decoding. Iterative decoder increases the decoding performance by allowing the probability information from other decoders to be used as part of the decoding process to provide an increase in the probability of producing the correct codeword at the decoder output.

Soft-Input/Soft-Output (SISO) decoder can be implemented using the Maximum A Posteriori (MAP) decoding algorithm; it provides not only the estimated sequence, but also the probabilities for each bit that has been decoded correctly. Turbo decoders with MAP algorithm offer better performance.

In this work, an adaptive iteration decoding strategy to reduce the complexity of the decoding is introduced. Turbo code has better performance as the number of iterations increases, but too many decoding iterations lead to more additional power consumption and decoding delay. As a result, it is important to find an efficient criterion; the Sign difference Ratio (SDR), to stop the iteration process and prevent unnecessary computation, decoding delay and power consumption. Also the decoder can be terminated without performance degradation.

Keywords - Turbo decoder, MAP algorithm, Log-likelihood ratio, Branch metric, State metric, Low power, SDR algorithm.