

Completely Asynchronous Multiple-Access Channels

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Some practical multiaccess strategies, such as code-division multiplexing, offer the possibility of simultaneous transmission of information from completely asynchronous users. In the information theory of the multiple-access channel, two types of synchronism are usually assumed among the transmitters, namely, frame and symbol synchronism. Frame synchronism refers to the ability of the users to start the transmission of their codewords in unison. The issue of symbol synchronism arises in those continuous-time channels where each codeword symbol modulates a fixed assigned waveform; the channel is symbol-synchronous if the users cooperate so that their symbol epochs coincide at the receiver. In practice symbol synchronism is harder to achieve, yet the only reported progress so far in multiuser information theory has been in the removal of the assumption of frame synchronism in order to obtain the capacity region of the memory-less multiple-access channel. However, those results are not applicable to completely asynchronous channels, as the absence of symbol-synchronism introduces "memory" into the channel. In this talk we will summarize our results on the capacity region of multiple-access channels with memory and we will show how to apply those results to the derivation of the capacity region of completely asynchronous white Gaussian multiple-access channels. We will conclude that symbol asynchronism has a more profound effect on the capacity region than frame asynchronism, except when all transmitters are assigned the same waveforms, in which case channel capacity does not decrease in the absence of synchronism.