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Coherent time reversal communications in a shallow multipath environment

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Underwater acoustic channel is one of the less reliable communication channels due to its reverberant properties produced by the surface and the bottom of the sea and Doppler spreading caused by the transmitter and the receiver movements. Strong intersymbol interference (ISI) caused by time-varying multipath environments and relatively fast channel variations are two of the major challenges for practical implementation of coherent underwater acoustic communications. In this paper a phase conjugation is considered as a method for mitigating intersymbol interference in coherent communication and this technique reducing the complexity of underwater receivers. Phase conjugation uses time reversal to remove intersymbol interferences. This method performs the time reversal operation in the computer at the receiver instead of time reversed propagation through the sea. This paper presents numerical simulations results of coherent communications using this technique. Phase conjugation processing in acoustic communications was demonstrated with the transmission of BPSK and QPSK modulation schemes. Different messages were sent simultaneously to different depths at different ranges in 100m deep shallow water. Simulation results suggest that the phase conjugation technique may be used as a potential application to undersea communications, especially in an environment with significant multipath.