

Demonstration of PC-based and DSP-based Implementations of an OFDM Acoustic Modem

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The success of multicarrier modulation in the form of OFDM in radio channels illuminates a path one could take towards high-rate underwater acoustic communications, and recently there are intensive investigations on underwater OFDM.

In this workshop, we would like to demonstrate two projects that have been undertaken at University of Connecticut on the implementations of an OFDM acoustic modem, whose receiver algorithms are developed in [1], [2].

- PC-based implementation as described in [3]. This implementation is based on Matlab programming on two laptops, as shown in Fig. 1. Two laptops can communicate with each other via two-way acoustic links.
- DSP-based implementation as described in [4]. This implementation is based on a TMS320C6713 DSP board, as shown in Fig. 2. For an OFDM block duration of 230 ms, the demodulation-plus-decoding time at the receiver is about 200 ms, and hence a *real-time* one-way communication is accomplished. The bandwidth is 5.5 kHz, and the overall data rate is 3.1 kbps after rate 1/2 convolutional coding.

These prototypes work well for in-air acoustic channels and are expected to work well for underwater acoustic channels with stationary transceivers [3]. The resampling operation in [2] for fast-varying channels due to mobile transceivers has not been implemented.

Space requirement:	two desks
Equipment requirement:	none

REFERENCES

- [1] B. Li, S. Zhou, M. Stojanovic, and L. Freitag, "Pilot-tone based ZP-OFDM demodulation for an underwater acoustic channel," in *Proc. of MTS/IEEE OCEANS conference*, Boston, MA, Sept. 18-21, 2006.
- [2] B. Li, S. Zhou, M. Stojanovic, L. Freitag, and P. Willett, "Non-uniform Doppler compensation for zero-padded OFDM over fast-varying underwater acoustic channels," in *Proc. of MTS/IEEE OCEANS conference*, Aberdeen, Scotland, June 18-21, 2007.
- [3] S. Mason, R. Anstett, N. Anicette, and S. Zhou, "A broadband underwater acoustic modem implementation using coherent OFDM," in *Proc. of National Conference for Undergraduate Research (NCUR)*, San Rafael, California, April 2007.
- [4] H. Yan, S. Zhou, Z. Shi, and B. Li, "A DSP implementation of OFDM acoustic modem," in *Proc. of the ACM International Workshop on UnderWater Networks (WUWNet)*, Montréal, Québec, Canada, September 14 2007.

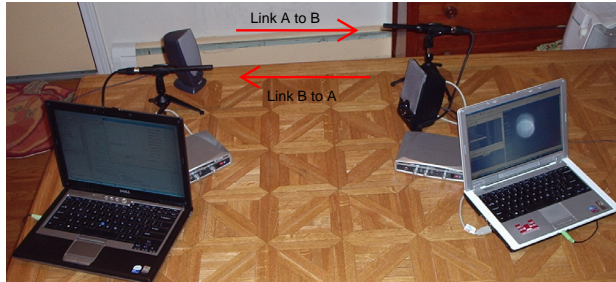


Fig. 1. The PC-based prototype with two-way communication



Fig. 2. The DSP-based prototype for real-time one-way communication