

# Digital Signal Processing for Underwater Acoustic Communications

Koen C.H. Blom\*, André B.J. Kokkeler, and Gerard J.M. Smit

\*Dep. of Electrical Engineering, Mathematics and Computer Science  
University of Twente, P.O. Box 217, 7500 AE, Enschede, The Netherlands  
Email: k.c.h.blom@utwente.nl

*Abstract*—A growing interest in underwater monitoring systems requires considerable research efforts in (physical layer) underwater communications. Our project, STW project SeaSTAR, is a cooperation between three research chairs and envisions a coarse-grained underwater monitoring system consisting of multiple underwater wireless sensor nodes. Application areas are e.g., environmental monitoring and harbor monitoring.

Our work is focused on designing Digital Signal Processing methods to compensate for the signal distortion caused by the underwater channel. The three most important characteristics of the underwater channel are: low (variable) propagation speed, frequency-dependent attenuation and time-varying multipath.

Different techniques exist for compensating the distortion of the underwater channel. We have chosen to exploit spectral and spatial equalization techniques. Spectral equalization compensates the channel's frequency-selectivity caused by constructive and destructive interference of multipath components. Spatial equalization combines signals from different (synchronous) receivers to create angular regions with high sensitivity to improve reception from a certain direction. The latter is also known as beamforming.

Recent experiments, in a diving center, have been performed to collect data for evaluation of our novel spatial and spectral equalization methods. Currently, our algorithms are being evaluated using this experimental data.