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Performance comparison of IDMA receivers for underwater acoustic channels

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Abstract:

Two promising single-element downlink interleave division multiple access (IDMA) receivers, employing adaptive decision feedback equalization and soft Rake-based IDMA structures, are proposed for multi-user underwater communications applications. A Chip level DFE-based receiver is optimized using the mean square error criterion (MSE), which is generated by exchanging soft information in terms of log-likelihood ratio (LLR) estimates with each user's channel decoder. Soft Rake-based conventional IDMA receiver in conjunction with the soft channel estimation is also adopted iteratively using regenerated multiple access interference (MAI) signal. In both receivers, carrier phase tracking is optimized jointly and detection is implemented using soft chip cancellation to remove multi access interference (MAI) effects between users. The receivers' equations describing the detection algorithms are derived, and their performance is investigated in short range shallow water acoustic channels using signals acquired during sea-trials in the North Sea. Results for synchronous multi-user scenarios with 2 and 4 users, at an effective rate of 439.5 bps per user, demonstrate that the DFE-based IDMA receiver outperforms the standard soft Rake IDMA receiver.

Published in: [2010 7th International Symposium on Wireless Communication Systems](#)

Date of Conference: 19-22 Sept. 2010

Date Added to IEEE *Xplore*: 09 November 2010

ISBN Information:

ISSN Information:

INSPEC Accession Number: 11639641

DOI: [10.1109/ISWCS.2010.5624402](https://doi.org/10.1109/ISWCS.2010.5624402)

Publisher: IEEE

Conference Location: York, UK

Keywords

Receivers, Decision feedback equalizers, Channel estimation, Decoding, Phase shift keying, Interference, Multiuser detection