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Channel estimation for underwater acoustic communications: sparse channels, soft input data, and Bayesian techniques

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The problem of estimating the time-varying impulse response of the communications channel is central to creating reliable and high-rate communications links. Past work has shown that by jointly accounting for channel dynamics and sparse channel characteristics, the accuracy of the channel impulse response estimate is improved with a corresponding improvement in communications systems performance. Following a survey of the basic techniques that have been developed, these basic techniques are extended in two ways. The first allows for a more complete accounting for the channel characteristics via apriori distributions on the probabilities of the complex channel tap values and optimized basis functions for sparse channel structure. The second allows for the use of soft input data in the channel estimation process thus making the techniques feasible for iterative channel estimation and data estimation algorithms. The extensions are developed and their performance compared using data from recent shallow water acoustic communications experiments.