Multipath Channel Estimation Using Two-Step Maximum Likelihood Method

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Channel estimation is an issue of importance to both passive Radar and mobile communication applications. In such scenarios, a signal is sent through a time-varying multipath channel that severely distorts it. The need for channel estimation arises since the response of the multipath channel/transmit-filter cascade (referred to as the "channel response") is assumed to be unknown at the receiving end.

Blind estimation methods attempt to exploit apriori knowledge of both the statistics of the transmitted signal and structure of the channel. Among these methods, the Maximum Likelihood estimators are quite popular, partly due to the fact that they enjoy the property of asymptotically approaching the Cramer bound. Recently, Hua (Y.Hua, IEEE Trans Sig Proc,661-672,March 1996) introduced the two-step Maximum Likelihood (TSML) method for blind channel estimation. TSML is distinctive in requiring only two iterative steps, each involving minimization of a quadratic function.

Like other channel estimation methods, however, TSML in its original formulation does not take into account additional apriori knowledge that is often available at the receiver. Specifically, the transmit filter is often known, and as such, only estimation of the multipath channel rather than the multipath channel/transmit-filter cascade is required.

In this paper, we show how Hua's TSML method may further be extended to incorporate apriori knowledge of the transmit-filter, and assess the resulting improvement in its performance. In particular, we show how this additional knowledge further constrains the overall system model by reducing the dimensionality of the problem. Additionally, through simulations, we demonstrate various cases where TSML fails without knowledge of the transmit-filter, whereas with this knowledge, it yields satisfactory performance.