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Multipath Parameter Estimation from OFDM Signals in Mobile Channels

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(Submitted on 12 Nov 2010 (v1), last revised 15 Nov 2010 (this version, v2))

We study multipath parameter estimation from orthogonal frequency division multiplex signals transmitted over doubly dispersive mobile radio channels. We are interested in cases where the transmission is long enough to suffer time selectivity, but short enough such that the time variation can be accurately modeled as depending only on per-tap linear phase variations due to Doppler effects. We therefore concentrate on the estimation of the complex gain, delay and Doppler offset of each tap of the multipath channel impulse response. We show that the frequency domain channel coefficients for an entire packet can be expressed as the superimposition of two-dimensional complex sinusoids. The maximum likelihood estimate requires solution of a multidimensional non-linear least squares problem, which is computationally infeasible in practice. We therefore propose a low complexity suboptimal solution based on iterative successive and parallel cancellation. First, initial delay/Doppler estimates are obtained via successive cancellation. These estimates are then refined using an iterative parallel cancellation procedure. We demonstrate via Monte Carlo simulations that the root mean squared error statistics of our estimator are very close to the Cramer-Rao lower bound of a single two-dimensional sinusoid in Gaussian noise.

Comments:	Submitted to IEEE Transactions on Wireless Communications (26 pages, 9 figures and 3 tables)
Subjects:	**Information Theory (cs.IT)**
Cite as:	**arXiv:1011.2809v2 [cs.IT]**

Submission history

From: Nicholas Letzepis A [view email]
[v1] Fri, 12 Nov 2010 01:53:59 GMT (735kb,D)
[v2] Mon, 15 Nov 2010 01:10:41 GMT (735kb,D)

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