Direct Ranging in Multi-path Channels Using OFDM Pilot Signals

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Abstract:

Ranging using OFDM signals is becoming of great importance for positioning using terrestrial wireless networks. Conventional ranging methods rely on a two-step approach: range related estimates, such as time of arrival (TOA), the bias induced by non-line-of-sight (NLOS) propagations etc., are first computed, based on which the range is then estimated. Common range estimators use a correlator, an energy detector, or a multidimensional search procedure to estimate the delays of separable multi-path components. These estimators either provide inferior ranging accuracy or suffer from complexity in multi-path channels. In this work, we propose a novel direct ranging technique that uses a point process formulated channel model. We derive an approximate maximum likelihood estimator of the range. In contrast to the estimator which requires a multidimensional search procedure, the proposed estimator does not need to know the exact number of multi-path components and to assume that these components are separable. If the power delay spectrum of the multi-path channel and the signal-to-noise-ratio (SNR) are known, the complexity of the proposed estimator is tractable. We show by means of Monte Carlo simulations that the proposed estimator
outperforms the correlator-based estimator.