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Research Letter

Modeling Distance and Bandwidth Dependency of TOA-Based UWB Ranging Error for Positioning

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Abstract

A statistical model for the range error provided by TOA estimation using UWB signals is given, based on UWB channel measurements between 3.1 and 10.6 GHz. The range error has been modeled as a Gaussian random variable for LOS and as a combination of a Gaussian and an exponential random variable for NLOS. The distance and bandwidth dependency of both the mean and the standard deviation of the range error has been analyzed, and insight is given in the different phenomena which affect the estimation accuracy. A possible application of the model to weighted least squares positioning is finally investigated. Noticeable improvements compared to the traditional least squares method have been obtained.