

# Dilution of Position Calculation for MS Location Improvement in Wireless Communication Systems

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## Abstract

Geometric dilution of precision (GDOP) represents the geometric effect of base stations (BSs) and mobile station (MS) on the relationship between measurement error and positioning determination error. When the measurement variances are equal to each other, GDOP could be the most appropriate selection criterion of location measurement units. GDOP expression has simpler form if all the measurements are with the same variance. For time of arrival (TOA) schemes, the maximum volume method of GDOP calculation doesn't guarantee the optimal selection of the four measurement units. The conventional method for calculating GDOP is to use matrix inversion to all subsets. GDOP was originally used as a criterion for selecting the right 3D geometric configuration of satellites in global positioning systems (GPS). In this paper, we employ GDOP using the matrix inversion method to select appropriate BSs in cellular communication systems. The proposed BS selection criterion performs better than using the random subsets of four or five BSs chosen from all seven BSs. After BS selection, the proposed distance-weighted method and threshold method for TOA schemes can yield superior MS location estimation accuracy. For time difference of arrival (TDOA) schemes, the proposed BS selection criterion provides better MS location estimation. From simulation results, the performances of MS location strongly depend on the relative position of the MS and BSs. Therefore, it is very important to select a subset with the

most appropriate BSs rapidly and reasonably for positioning.

Keyword : Terms—geometric dilution of precision, time of arrival, time difference of arrival, non-line-of-sight