# Comparison of QCLS Location Algorithms Using Two-Way Ranging Measurements

Jeong-Min Lim

Dept. of Information and Communication Engineering
Chungnam National University
Daejeon, Korea
likebasic@cnu.ac.kr

Ji-Won Park

Dept. of Information and Communication Engineering
Chungnam National University
Daejeon, Korea
jwjsjk@gmail.com

Tae-Kyung Sung

Dept. of Information and Communication Engineering
Chungnam National University
Daejeon, Korea
tksaint@cnu.ac.kr

## ABSTRACT

In case of outdoor or indoor location, iterative Gauss-Newton method is apt to diverge especially at poor geometry. To avoid divergence, quadratic corrected least square (QCLS) method was introduced for one-way ranging (OWR) time-difference-of-arrival (TDOA) measurements. It is guaranteed that the solution by QCLS would not diverge with high positioning accuracy compatible to GN method. Compared to the OWR, two-way ranging (TWR) measurements contain no clock bias. This paper presents two types of QCLS methods for TWR measurements; one is QCLS with standard TWR measurements, the other is QCLS with differenced squared-TWR measurements. Since the differenced squared-measurements lose parts of information contained in undifferenced measurements, a new correction method for differenced squared-measurements is proposed in this paper. By computer simulation, performances of QCLS methods are compared to that of Gauss-Newton (GN) method. Simulation results show that the performance of QCLS method using TWR measurement is almost similar to that of GN method. Performance of QCLS method using differenced squared-measurement is similar to or even better than GN method.

**KEYWORDS**: two-way ranging; localization, QCLS