Public Abstract

First Name:Le

Middle Name:

Last Name:Yang

Adviser's First Name:Dominic

Adviser's Last Name:Ho

Co-Adviser's First Name:

Co-Adviser's Last Name:

Graduation Term:FS 2010

Department:Electrical Engineering

Degree:PhD

Title:On the use of multiple emitters to improve the TDOA source localization accuracy in the presence of random sensor position errors

TDOA source localization is a fundamental problem in many systems such as radar, sonar, navigation and search and rescue. The localization task is achieved via first obtaining the source TDOAs at an array of sensors and then solving for the source location from the TDOA measurements.

It is known that if the sensor positions have random errors, the TDOA source localization accuracy would be greatly degraded. The use of calibration emitters was recognized as an effective method to mitigate the effect of random sensor position errors. The successful application of this idea has resulted in the differential calibration technique and the famous differential-GPS (D-GPS) system.

In this thesis, we conduct a fundamental and systematical study on using calibration emitters to improve the TDOA source localization accuracy. We consider the use of calibration emitters with different levels of location information, namely, with accurate, inaccurate or completely unknown location information. The goals are to quantize the amount of performance improvement and develop source localization algorithms to efficiently explore the calibration emitter signals to enhance the TDOA localization accuracy in the presence of random sensor position errors. We also show theoretically and experimentally that the differential calibration technique is in general not efficient. The theoretical findings in this thesis confirm that using calibration emitters can significantly improve source localization accuracy. More importantly, the proposed localization algorithms can be widely used in global navigation system such as GPS, sensor networks for tracking and surveillance purpose and microphone arrays for tracking speakers in video conference.