研究简报

WSN节点声测距TOA值频域估计方法

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摘要

该文研究了节点声测中TOA值的频域估计方法，与基于幅度检测的时域分析法相比，低信噪比下的测距精度高。它采用递归型的Goertzel短时频率分析算法。通过优化声信号频率及Goertzel算法窗口长度，实现了定点计算算法，节点采集测距信号的同时进行TOA值估计。论文还提出了一种多阈值的TOA值估计方法，提高了低信噪比下的TOA值检测精度。算法在一个具有dsPIC6014A微处理器的节点进行了验证。节点测距试验结果表明，该算法在低信噪比下的定位精度较高，可实现25 m内的节点测距和定位，测距误差<3%。

关键词　　无线传感器网络　节点定位　Goertzel算法　TOA　声测距

分类号　TP393　TN911.23

TOA Estimation Method in Frequency Domain for Acoustic Ranging of WSN Node

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Abstract

A new method of TOA (time of arrival) estimation in frequency domain used for wireless sensor nodes' acoustic ranging is proposed in this paper. It shows higher accurate results under lower signal-noise-ratio applications compare to the time-domain method such as amplitude detection. It is based on Goertzel algorithm for short time frequency analyses. Fixed point algorithm is achieved by adjusting acoustic ranging signal's frequency and window length. The computation of the algorithm can be done during one sampling period of microcontroller. A multi-magnitude threshold TOA estimate method is also studied for reducing the errors further. The algorithm has been tested on a node with a dsPIC6014A microprocessor. Experimental results show that the performance is better than those in time-domain. The acoustic ranging error is less than 3% at the distance of 25 meters.

Key words　Wireless sensor network　Node localization　Goertzel algorithm　TOA Acoustic ranging

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