

一种基于多普勒效应的水下无线传感器网络时间同步机制

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摘要:

时间同步是无线传感器网络的基础问题。由于电磁波在水下环境的传输衰减极大, 为此水下无线传感器网络通常采用超声波实现信息传输。由于超声波较低的传输速率和传感器节点在水中的运动, 必将导致严重的信号传输延迟。构建了一种基于多普勒效应的水下无线传感器网络时间同步机制, 通过检测接收到的超声波频率变化来实现时间同步校正。基于MATLAB实现了该同步算法的仿真。实验结果显示, 传感器的采样时间间隔越短, 移动速度越快, 在水中所处的深度越小, 整个系统的同步性越高。

关键词: 多普勒效应, 水下无线传感器网络, 时间同步, 时钟偏移

Design of a Time Synchronization Mechanism Based on Doppler Effect for Underwater Wireless Sensor Networks

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Abstract:

Time synchronization is the fundamental problem of wireless sensor networks. Transmission fading of radio in underwater environment is extremely large, so we often use ultrasound to transmit data in underwater wireless sensor networks. Due to the low transmission rate of ultrasound and moving of the sensor nodes in the underwater environment, it will lead to serious signal transmission delay. In this paper, we design a time synchronization mechanism based on Doppler Effect for underwater wireless sensor networks. It can achieve time synchronization correction by detecting the received ultrasonic frequency variation. We test the performance of the proposed synchronization mechanism by MATLAB. The experimental results show that, if the sampling time interval is shorter, the moving speed is faster and the depth of sensors in the water is smaller, the synchronicity will be higher.

Keywords: Doppler Effect, Underwater Wireless Sensor Networks, Time Synchronization, Clock Offset

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