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Simulation of periodic synchronization of UAV's clock

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Abstract

Unmanned aerial vehicles (UAVs) is one of the most fast progressing technologies. High space-time flexibility of UAV networks along with the ability to payload sensitive measuring equipment allows establishing aerial wireless sensor networks (AWSNs) with new qualities. However, establishing a rapidly reconfigurable phased antenna array system for precise spatially distributed measurements requires a high-quality frequency-phase synchronization of the AWSN drones. Particularly, this paper relates to the problem of designing a synchronized AWSN with a centralized architecture. By a computer simulation, we assess an accuracy of the periodic synchronization of two crystal oscillators installed at the AWSN drones as onboard clocks. Two synchronization methods are considered: based on the total phase of a single carrier frequency and based on the differential phase of two carrier frequencies. It is shown that for most practical tasks it is sufficient to transmit a synchronizing signal with a period ranging from 1 to 20 seconds. The corresponding synchronization error of two onboard clocks can be held under 1.5 ns in the case of using of OCXO-oscillators and under 10.5 ns when using TCXO-oscillators, respectively.

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Keywords

Aerial wireless sensor network, Clock offset, Frequency stability, Quartz oscillator, Time synchronization, Unmanned Aerial Vehicles (UAV)

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