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Simulation of short-term instability 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. In particular, this paper relates to the problem of designing a synchronized AWSN with a centralized architecture. A model for simulating random frequency offset of two TCXO or OCXO crystal oscillators used as onboard frequency standards installed at the AWSN drones is presented. Our simulation results show that under continuous real-time synchronization, the synchronization error of the master and slave drones can be held under 1.5 ns for at least 100-second intervals.

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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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