Entry No. 2018CRZ8653

Title: NOVEL TECHNIQUES FOR HIGH-SPEED AND LONG-RANGE UNDERWATER VISIBLE LIGHT COMMUNICATION SYSTEM

Abstract

This research investigates novel techniques to enhance the performance of Underwater Visible Light Communication (UVLC) systems for high-speed and long-range data transmission. The study addresses key impairments such as absorption, scattering, turbulence, and geometrical losses, which significantly degrade signal quality in underwater environments. Analytical models are developed for Bit Error Rate (BER) and Q-factor under varying conditions, including different water types, modulation schemes, photodiodes, input power levels, and oceanic depths. Comparative analysis of PIN and Avalanche photodiodes, as well as internal and external modulation, highlights their impact on link reliability and efficiency. Further, the influence of transmitter divergence angle, receiver aperture, and photodiode responsivity on system performance is systematically evaluated. Hardware implementation using NRZ-OOK modulation with a laser diode and photodiode validates the feasibility of achieving reliable underwater links, demonstrating superior bandwidth, low latency, and reduced noise compared to acoustic communication. The outcomes provide new insights into UVLC system design, offering a pathway toward robust and scalable real-time underwater communication networks.