

Abstract

Underwater optical wireless communication (UOWC) technology finds applications in oceanography research, seismic monitoring, oil exploration, naval surveillance, underwater wireless sensor networking (UWSN), and offshore engineering operations. Due to its high bandwidth and fastest data transmission supportiveness, UOWC technology is preferred for short-range communication rather than its counterpart underwater wireless acoustic communication (UWAC) and underwater wireless radio-frequency communication (UWRFC) technology. The UOWC system faces various challenges, e.g., absorption, scattering, turbulence, misalignment, and background noise interference. Solar light is a significant noise contributor in the undersea background noise category. It exists in the ocean's euphotic zone for the whole day. It severely degrades the UOWC system performance by interfering with transmitted light at the system receiver (Rx). In this thesis, at first, the detrimental effect of solar noise on the UOWC system performance is theoretically investigated using various photodetectors (PDs) and discussed on cancellation of solar noise interference to the UOWC system when its Rx faces different orientations, e.g., vertically upward (VU), horizontally leftward (HL), and vertically downward (VD). Secondly, the UOWC system performance is studied using various optical filters to suppress the solar noise interference when the system Rx faces VU, HL, and VD orientations. Thirdly, a computational model to find orientation-specific energy-efficient RS code is presented for the UOWC system. Lastly, the solar noise effect on the optical wireless communication (OWC) system is experimentally investigated by pointing the system Rx towards different orientations.

Keywords: OWC, UOWC, Orientation-based solar noise, Receiver orientation, Solar noise, Solar noise cancellation, Optical filter, Photodetector, Reed-Solomon code,