# ON THE ESTIMATION OF UNDERWATER OPTICAL COMMUNICATION SYSTEM PERFORMANCE pdf

## 1: Analysis_of_Optical_Wireless_Communication_for_Underwater_Wireless_Communication

*Underwater Optical Wireless Communication Abstract: Underwater wireless information transfer is of great interest to the military, industry, and the scientific community, as it plays an important role in tactical surveillance, pollution monitoring, oil control and maintenance, offshore explorations, climate change monitoring, and oceanography.*

It is achieved that pure ocean water has presented the highest signal to noise ratio compared to other ocean water types under the same operating conditions. It is achieved that pure ocean water has presented the lowest bit error rate compared to other ocean water types under the same operating conditions. Sharshar distance and increasing operating optical signal wavelength for different ocean water types under considerations. It is achieved that pure ocean water has presented the highest both transmitted signal bandwidth and transmission bit rates compared to other ocean water types under the same operating conditions. Free space optical communications is a line of sight technology that transmits a modulated beam of visible or infrared light through the atmosphere or as in our study concerning on wireless system underwater for broadband communications. It represents one of the most promising approaches for addressing the emerging broadband access market. It offers many features, principal among them being low start up and operational costs, rapid deployment and high fiber link bandwidth. Wireless optical communications under water primarily deployed where performance, security, rapid deployment, and cost-savings are critical issues. It is theoretically found that the increased operating optical signal wavelength, transmission distance, and transmitter lens diameter, also the increased transmitted signal power, and receiver aperture diameter resulting in the increased received signal power for different ocean water types under the same operating conditions. As well as it is achieved that SNR increases and BER decreases with the increased transmitter signal power, transmitter lens diameter, operating optical signal wavelength, and receiver aperture diameter and the decreased transmission distance. Moreover it is indicated the transmitted signal bandwidth and transmission bit rates increases with the increased operating optical signal wavelength and transmission distance for different ocean water types. Therefore it is concluded that pure ocean water has presented the highest received signal power, transmitted signal bandwidth, transmission bit rates, and signal to noise ratio, and the lowest bit error compared to other ocean water types under the same operation considerations. Medium access control protocols in cognitive radio networks. Wireless Communications and Mobile Computing Journal, 10 1 , 31â€" FAMIS frequency agile modulated imaging system sensor for imaging in turbid water. A significant step towards closing the loop between theory and experiment. Performance and diversity analysis of decode- and-forwardcooperative system over Nakagami-m fading channels. 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Canadian Journal on Electrical and Electronics Engineering, 2 12 , â€” Analysis of optical wireless communication for underwater wireless communication. Paving the way for a future underwater omnidirectional wireless optical communication systems. Ocean Engineering, 13 2 , â€" Upgrading efficiency and improvement of the performance of broadband wireless optical access communication networks. High transmission performance of radio over fiber systems over traditional optical fiber communication systems using different coding formats for long haul applications. Nonlinear Optics and Quantum Optics, 44 1 , 41â€" Transmission characteristics of radio over fiber ROF millimeterwave systems in local area optical communication networks. International Journal of Advanced Networks and Applications, 2 6 , â€" Radio over fiber communication systems over multimode polymer optical fibers for short transmission distances under modulation technique. He received the B. Postal Menouf city code: His scientific master science thesis has focused on polymer fibers in optical access communication systems. Moreover his scientific Ph. His interesting research mainly focuses on transmission capacity, a data rate product and long transmission distances of passive and active optical communication networks, wireless communication, radio over fiber communication systems, and optical network security and management. He has published many high scientific research papers in high quality and technical international journals in the field of advanced communication systems, optoelectronic devices, and passive optical access communication networks. His areas of interest and experience in optical communication systems, advanced optical communication networks, wireless optical access networks, analog communication systems, optical filters and Sensors, digital communication systems, optoelectronics devices, and advanced material science, network management systems, multimedia data base, network security, encryption and optical access computing systems. As well as he is editorial board member in high academic scientific International research Journals. Moreover he is a reviewer member in high impact scientific research international journals in the field of electronics, electrical communication systems, optoelectronics, information technology and advanced optical communication systems and networks. Currently, his job carrier is Asscoc. His scientific master science thesis has focused on Electromagnetic scattering by plane and curved surfaces. As well as his scientific Ph. His interesting research mainly focuses on wireless communication, radio over fiber communication systems, and optical network security and management. His areas of interest and experience in wireless optical access networks, analog communication systems, optical filters and Sensors, network management systems, multimedia data base, network security, encryption and optical access computing systems.

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## 2: Sensors | Special Issue : Underwater Sensing, Communication, Networking and Systems

*Abstractâ€” This paper has presented the deep analytical study of free space and under water optical wireless communication systems performance parameters estimation over wide range of the affecting parameters.*

All tests were conducted in a 3. One end of the tank was equipped with a large window while the opposing end was equipped with a 20 cm view-port. Both windows are constructed from 0. The tank holds approximately 3, liters of water. During experimentation a separate circulation pump was used to keep the water moving and any particulate in suspension. In order to simulate the scattering effects of ocean water, a commercial antacid, Maalox a mixture of aluminum and magnesium hydroxide , was added to the water due to its similar scattering phase function to natural waters [18]. While the scattering function is similar, it should be noted that Maalox produces less forward scattering than natural waters and also exhibits a higher scattering vs. For optical links operating at very high attenuation lengths, or links that capture a large amount of scattered photons, Maalox experiments will yield a higher number of captured photons than natural waters. This was done to reduce the complexity of the receiver and eliminate the need for bit synchronization between receiver and transmitter. The bit-error rate was adjusted for this, but at very low SNRs, where bit errors may be adjacent, the BER can be underestimated. The signalto-noise ratio SNR was estimated using the squared mean of the received data divided by the measured variance of the data. A more sophisticated SNR estimator could be used to reduce the scatter of the estimates, but this method was judged to be adequate for determining a trend. In the future, various other modulation schemes can be tested and compared, while the modulation schemes presented here were used for convenience. Instead of using multiple instruments at various wavelengths, to measure the attenuation at other operating wavelengths, an experiment was conducted to determine the attenuation at the minimum wavelength. The results are shown in Fig. A photodetector was used to measure the power of a nm laser propagating through the water as Maalox was added. The detector had a 2. It is clear that the divergence can be minimized by maximizing the focal length of the lens or by choosing an emitter with a small spot size. For high-power LEDs, where the emitter size is large, focal length must be maximized, but at the expense of captured light by the transmitter optics. This shows that the geometric loss is proportional to the square of the divergence angle. The amount of light captured by the transmitter lens is proportional to the angle subtended by the lens. Simulations and experiments showed that the divergence of the beam should be minimized rather than minimizing the focal length of the transmitter lens of the LED to achieve maximum power at the receiver. Ideally, the transmitter lens would be maximized, while assuring the beam spot size at the receiver is less than or equal to the receiver aperture.

## 3: Underwater Optical Communication Using Software - IEEE Xplore - www.enganchecubano.com

*With the rapid development of light emitting diode (LED), visible light communication (VLC) becomes an important technique for information transmission including underwater applications. However, accurate channel estimation for underwater VLC is still challenging due to the complex environment of.*

Narender Abstract- Recently, the importance of underwater wireless optical communication has been grown for applications of underwater observation and sea monitoring systems. This communication technology is expected to play a prominent role in investigating climate changes, prediction of natural disasters, discovery of natural resources, marine biology in lake, sea, and ocean environment. Optical wireless communication has been proposed as the best alternative in order to overcome the limitations in acoustic underwater communication. In this paper we have presented three scenarios regarding underwater optical wireless communication. In this analysis, each scenario has been tested with water having different extinction coefficient and various noise backgrounds. Opti System is an innovative, rapidly evolving, and powerful software design tool that enables users to plan, test, and simulate almost every type of optical link in the transmission layer of a broad spectrum of optical networks from LAN, SAN, MAN to ultra-long-haul. It offers transmission layer optical communication system design and planning from component to system level, and visually presents analysis and scenarios. Nowadays acoustic technology is mostly used for establishing wireless communication link Among divers and ships, or sending long range remote signals. This is because sound waves travel through water faster than in air, receiving very little attenuation. However, due to frequency attenuation characteristic of acoustic waves in water, it is difficult to expand its bandwidth. Therefore acoustic approach cannot achieve high data rate, and also portable communication devices are difficult to be designed at lower cost. Even though the electromagnetic waves are so widely used there are some portions of our planet that are not suitable for these types of transmissions. In this realm the use of electromagnetic waves is very difficult, if not impossible, due to large attenuations of the electric and magnetic filled, this limits it range and effectiveness to transmit data. The other types of wave known are mechanical waves, for the underwater channel acoustics waves are the only solution for wireless communication. Acoustics waves can travel so much easily especially in sea water, where salinity shows strong conductivity. Since humans are limited in their ability to work underwater, remotely operated vehicles ROVs and such as collecting data and retrieving items. Operation of these vehicles is challenging , but oil resources are found further off shore, ROVs and AUVs are required to go deeper and stay deployed longer in perform critical tasks. One such task is monitoring a deep sea oil well-sending tethered ROVs thousands of meters below the surface in order to conduct survey is expensive and time consuming. To overcome this challenge we need underwater optical wireless communication system. Cochenour, Mullen and Laux [8] measure both the spatial and temporal effects of scattering on a laser link in turbid underwater environments. Using Monte Carlo simulations and measurement results, they predict longer- range underwater optical free-space optical performance with bandwidths greater than 5 GHz for a range of 64 m in clear ocean water, dropping to a range of 1 GHz for a range of 8 m in turbid harbour water. Smart [9] examines the fundamental physics and natural variability of underwater optical attenuations and discusses the design issues underwater optical wireless communication associated with ocean physics and parameter variability. Arnon [11] examine the potential of subsea free- space optics for sensor networks applications. Leveraging the emerging technologies of high sensitive photon counting detectors and semiconductor LED and laser light source in the solar blind UV. The paper by jaruwatanadilok [11] presents the modelling of an underwater wireless optical communication channel using the vector radiation transfer theory. The vector radiative transfer equation link. All the three links we discuss provide required data rate. We also present the performance analyses on the three links. From the analyses it is clear that water absorption increases due to changes in turbidity, the communication performance decrease dramatically for all three link types, but the modulated reflector link is the most affected. However, the absorption coefficient increases more moderately than does the water turbidity. We conclude from the analyses that a high data rate underwater optical wireless network is a feasible solution for emerging applications such as UUV to UUV links and networks of sensors. The analyses also include opti system. This software design tool have some benefits such as Providing global insight into system performance, Assessing parameter sensitivities aiding design tolerance specifications, Visually presenting design options and scenarios. Here in this paper we present about three models of optical wireless communication 1. Modulating retro reflector link 3. Reflective Light pulses propagating in aquatic medium suffer from attenuation and broadening in the spatial, angular, temporal and polarization domains. The attenuation and broadening are wavelength dependent and result from absorption and multi-scattering of light by water molecules and by marine hydrosols mineral and organic matter. It is clear that increase in the turbidity dramatically increases the extinction coefficient from less than 0. However the absorption coefficient increases more moderately than does the turbidity. In addition, we perform a bit error rate BER calculation. Line-of-Sight Communication Link Line of sight is a straight and unobstructed path of communication between transmitter and receiver. This is the most common link between two points in optical wireless communication system. The figure represents line of sight LOS. In this scenario, the transmitter directs the light beam in the direction of the receiver. Shows the line of sight communication link. Modulating Retro Reflector Communication Link A Modulating Retro Reflector MRR system combines an optical retro reflector and an optical modulator to allow optical communications and sometimes other functions such as programmable signage. The modulating retro-reflector link is used when one party for example, a submarine has more resources another one for example, a diver , as in Fig 2. In this case, the submarine has more energy, payload, and lifting capacity than the diver. Therefore it would be wise to put most of the complexity and power requirement of the communication system into the submarine. In a modulating retro-reflector link, the interrogator sits at one end in our case, in the submarine , and a small modulating optical retro-reflector sits at the remote end. In operation, the interrogator illuminates the retro-reflecting end of the link with a continuous wave beam. The retro reflector in actively reflects this beam back to the interrogator while modulating the information on it. Shows the modulating retro reflective communication link 3. Reflective Communication Link In some communication scenarios the line of sight is not available due to obstructions, misalignment, or random orientation of the transceivers. To address this problem a reflective communication link could be used. In this case, the laser transmitter emits a cone of light, defined by inner and outer angles 8minand8max, in the upward direction. Here 8i and 8t are the angles of incidence and of transmission, respectively. The light reaching the ocean-air surface illuminates an annular area and is partially bounced back in accordance with the reflectivity. Since the refractive index of air is lower than that of water, total internal reflection TIR can be achieved above a critical incidence angle. Shows the reflective communication link 4. This leads to the reduction of expected data rate. In the fig 9 and fig 12 the eye patterns of the retro reflector link and reflective link has been given respectively. In both of them the noise levels are very high which results in ineffective communication between transmitter and receiver and data rate is reduced. From this we can know that the effectiveness of each water type changes with the change in value of 8. The same we can observe in modulating retro reflector link and reflective link also. Hence the turbid harbour water creates a bad impact on the data rate than the other two water types. Hence line of sight link is more effective than the other two links. TABLE 1 These are the parameters used in the numerical calculation consistency of receiver power in the three scenarios. We have analysed the output of the receiver using different analysers such as RF spectrum analyser, oscilloscope visualizer, eye diagram analyser, BER calculator. From fig 4 we can infer that for a time bit period of 0.

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