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Performance of Under Water Optical Wireless Communication System

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Abstract: ***This article belongs to under water optical system specially used to link costal vehicles. the sensor network wireless communication play an important role in under water optical communication. It also monitoring biological, biogeochemical, evolutionary, and ecological changes in the sea, ocean, and lake environments, and in helping to control and maintain oil production facilities and harbors using unmanned underwater vehicles, submarines, ships, buoys, and divers. The properties of light travel through the water changes. One of the main targets in UOWC channel modeling is to evaluate the overall path loss which is essential for calculating link budgets and signal-to-noise ratio. we propose a fast numerical solution for the steady state radiative transfer equation in order to calculate the path loss due to light absorption and scattering in various type of underwater channels.***

Keywords: ***Underwater Optical Communication (UWOC), Radiative Transfer Equation (RTE).***

I. INTRODUCTION

Today demanding the technology inside the water submarines application optical network. The growing need for underwater observation and subsea monitoring systems has stimulated considerable interest in advancing the enabling technologies of underwater wireless communication and underwater sensor networks[1][5,8]. The sensor network established for underwater wireless sensor network with various nodes which is connected each other for exchange the information. This can be used to An UWSN consists of spatially distributed autonomous nodes to which a number of sensors are connected. These nodes are linked together to exchange the data collected by the sensors. The network can be used for assessing the aqueous environment, monitoring the seafloor activity for disaster prevention (for example, surveillance of seismic activities in order to provide tsunami warnings), helping underwater geochemical prospecting, modeling the weather impact on the submarine life, etc[5].Optical and Acoustical signal transmission underwater is of necessary interest for many human applications. The present technology uses acoustic waves for underwater communication whose performance is limited by low bandwidth, high transmission losses, time varying multipath propagation, high latency and Doppler spread. All these factors lead to temporal and spatial variation [1-5][8-13].

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The Beer's law which is essentially the simple exponential attenuation model, is typically applied to calculate the optical path loss owing to its simplicity [8]–[10]. Here the radiative transfer equation model takes the multiple scattering for the calculation .the light propagation trough the water by means of scattering and emitting medium (e.g. water) [1-5].

II. PATH LOSS CALCULATION

To solve the integro-differential RTE numerically, we firstly discretize both angular and spatial variables and then solve the fully discretized large system of linear equations by a Gauss-Seidel iteration method [5].

A. Angular Discretization

As the VSF of ocean water is highly peaked in the forward direction, we take advantage of this inherent quality to accelerate the calculation by a direct non-uniform angular discretization. In the 2D case, the angular variable ranges in [0, 2π). The proposed scheme can capture the characteristic of scattering in water more effectively and maintain good accuracy with much reduced number of discrete angular directions K [5].

B. Spatial Discretization

The highly collimated light source is placed in the middle of the left boundary and the receiver is aligned on the opposite side XOY plane. We assume vacuum boundary condition which means that the incoming radiance on the boundary of the interested area of water body is zero[5].

III. RESULTS AND DISCUSSION

The parameters of three water types investigated in the simulation are listed in Table 1 below . Al of them are the typical values of coastal and harbor waters. The single scattering albedo is defined as the ratio of b/c [5].

Table 1.Types of Water used for Simulation

Water type	$c(m^{-1})$	Albedo
Coastal	0.568	0.60
Harbor 1	1.1	0.85
Harbor 2	2.19	0.85

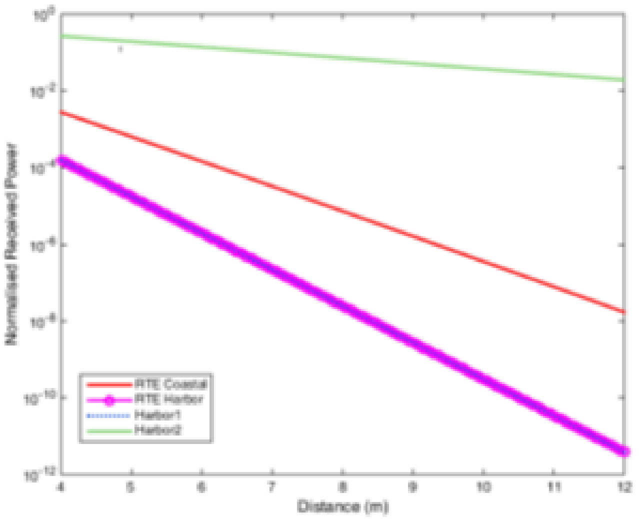

Figure. 1 Normalized Received Power Versus Transmit Distance for Receiver Aperture = 0.1m

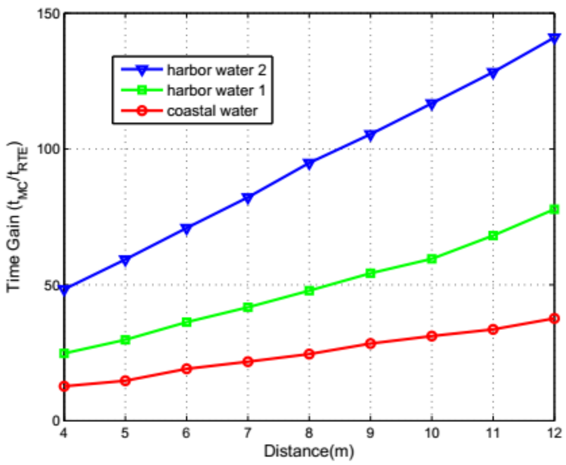

Figure 2. Time Gain Versus Transmit Distance for Receiver Aperture = 0.1m

Figure 1 is depicted the normalized received power at different transmit distance for different types of water. Figure 2 shows the time gain versus transmit distance for receiver aperture given with efficiency of the proposed numerical RTE method in terms of ratio of simulation running time between MC and RTE. It shows that system is faster, However, it also affected by r more scattering with higher c [5].

IV. CONCLUSION

This article shows the proposed work solution is analyzed and work is efficient of RTE. The solution gives the path loss calculation of underwater optical wireless communication channel at the receiver by the radiance obtained from the RTE slover. It is cleared by simulation result the proposed system compute the received power with quickly that of MC with the accuracy of parameters.

REFERENCES

1. F. Miramirkhani and M. Uysal, "Visible Light Communication Channel Modeling for Underwater Environments With Blocking and Shadowing," in *IEEE Access*, vol. 6, pp. 1082-1090,2018. doi: 10.1109/ACCESS.2017.2777883
2. H. Kaushal and G. Kaddoum, "Underwater Optical Wireless Communication," in IEEE Access, vol. 4, pp. 1518-1547, 2016. doi: 10.1109/ACCESS.2016.2552538
3. A.Lin et al. "Underwater wireless optical communication using a directly modulated semiconductor laser" Proc. IEEE OCEANS pp. 1-4 May 2015.
4. K. Nakamura I. Mizukoshi M. Hanawa "Optical wireless transmission of 405 nm 1.45 Gbit/s optical IM/DD-OFDM signals through a 4.8 m underwater channel" Opt. Exp. vol. 23 no. 2 pp. 1558-1566 2015.
5. M. A. Khalighi M. Uysal "Survey on free space optical communication: A communication theory perspective" IEEE Commun. Surveys Tuts. vol. 16 pp. 2231-2258 Nov. 2014.
6. Changping Li, Ki-Hong Park, Mohamed-Slim Alouini , A Direct Radiative Transfer Equation Solver for Path Loss Calculation of UnderwaterOptical Wireless Channels ,Nov 2014
7. L. Lanbo, Z. Shengli, and C. Jun-Hong, “Prospects and problems of wireless communication for underwater sensor networks,” Wiley Online Library-Wireless Communications and Mobile Computing, vol. 8, no. 8, pp. 977–994, Oct. 2008.
8. G. Cossu, R. Corsini, A. Khalid, S. Balestrino, A. Coppelli, A. Caiti, and E. Ciaramella, “Experimental demonstration of high speed underwater visible light communications,” in Proc. IEEE 2nd International Workshop on Optical Wireless Communications (IWOW’2013), Newcastle, England, Oct. 2013, pp. 11–15.
9. J. Smart, “Underwater optical communications systems. Part 1: Variability of water optical parameters,” in Proc. IEEE Military Communications Conference (MILCOM’2005) , Atlantic, NJ, Oct. 2005, pp. 1140–1146.
10. J. W. Giles and I. N. Bankman, “Underwater optical communications systems. Part 2: Basic design considerations,” in Proc. IEEE Military Communications Conference (MILCOM’2005), Atlantic, NJ, Oct. 2005, pp. 1700–1705.
11. S. Arnon, J. Barry, G. Karagiannidis, R. Schober, and M. Uysal, Advanced Optical Wireless Communication Systems . Cambridge University Press, 2012.
12. F. Jasman and R. Green, “Monte Carlo simulation for underwater optical wireless communications,” in Proc. IEEE 2nd
13. Gabriel, M.-A. Khalighi, S. Bourennane, P. L´eon, and V. Rigaud, “Monte-Carlo-based channel characterization for underwater optical communication systems,” Journal of Optical Communications and Networking, vol. 5, no. 1, pp. 1–12, Jan. 2013.
14. W. Cox and J. Muth, “Simulating channel losses in an underwater optical communication system,” Journal of Optical Society of America, vol. 31, no. 5, pp. 920–934, May 2014

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