

## Abstract

The advancement in wireless communication and micro-electronics led to the advent of Underwater Wireless Acoustic Sensor Networks (UWASNs). A UWASN consists of sensor nodes and underwater vehicles that typically communicate using the acoustic mode under the surface of water. During the last few years, UWASNs have attracted the attention of many researchers having the necessity of monitoring different oceanic physical phenomena. The existing body of literature on UWASNs mostly assumes an ideal oceanic environment. However, oceanic environments are vastly dynamic, and they potentially affect the performance of UWASNs deployed in them. In this Thesis, we attempt to analyze this research lacuna.

Our proposed research mainly focuses on the underwater wireless channel and mobility of nodes. Specifically, we study the performance of UWASNs in challenging communication channels affected by oceanic phenomena such as *bubble plumes*, *internal waves*, and *internal solitons*. Additionally, we have considered the effects of *oceanic force induced 3D node mobility* in UWASNs.

In our study on bubble plumes, we have considered the effects of near-surface bubble plumes on the performance of UWASNs. We have studied the dependency of the near-surface plumes on wind and then analyzed their effects on the network performance. In another work, we have stochastically modeled the inter-node communication in UWASNs in the presence of internal waves. We have shown how the acoustic signal field of nodes gets perturbed due to the presence of internal solitons and then evaluated the network performance in terms of signal-to-interference-plus-noise ratio (SINR), bit error rate (BER), delay, and average energy consumption per node.

Finally, we have modeled the mobility of nodes in 3D oceanic environment. The model computes the velocity and space co-ordinates of a node. Further, we have evaluated the performance of such mobile UWASNs in terms of four metrics, namely, dispersion of nodes, localization coverage, delay, and average energy consumption per node.

**Keywords:** Sensor node, sensor network, acoustic signal, network performance