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Comparison of submerged and floating Wireless sensor networks for monitoring underwater sediment transport

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Wireless sensor networks (WSNs) are an enabling technology in terms of monitoring the environment as they can be deployed in locations which cannot easily be reached manually, such as underwater, making it possible to gather data that was previously unavailable. Underwater sensor networks (UWSNs) are submerged in the body of water in which they are operating and use acoustic waves as a transmission medium, which is the most reliable and robust medium for underwater transmissions, despite suffering from such issues as extremely low bandwidth, and vulnerability to adverse effects caused by conditions such as turbidity, ambient noise, salinity, and pressure gradients. Radio frequencies (RF) and optical communications are two alternative mediums, and although both have been proven to work in underwater deployments, they both suffer from limited range, and, in the case of the former, electromagnetic interference (EMI). Optical communications, despite far greater bandwidth capacities, it is only a realistic approach in very clear water, being a light based medium. Regardless of the communication medium that is used, there are further problems relating to deployment, maintenance, and cost associated with UWSNs. As such, it is worthwhile to evaluate the merits of different types of WSN deployment. To this end, a comparative assessment is presented of submerged pressure sensors and echo sounding floating WSN deployments for the purpose of monitoring sediment transport on the seabed.

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A MIMO Optimization for Physical Layer Security

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The use of multiple antennas at both the transmitter and receiver aims to improve performance or to increase symbol rate of systems, but it usually requires higher implementation complexity. Multiple Input Multiple Output (MIMO) architectures can be used for combined transmit and receive diversity, for the parallel transmission of data or spatial multiplexing. When used for spatial multiplexing, MIMO technology promises high bit rates in a narrow bandwidth. Therefore, it is of high significance to spectrum users. In this case, MIMO system considers the transmission of different signals from each transmit element so that the receiving antenna array receives a superposition of all transmitted signals.

Mobile communication systems must support multiple users achieving at the same time privacy of users contents. Security common solutions are based on encrypted algorithms from higher layers, such as private and public encrypted keys. Other possibility is to implement physical layer security schemes. One advantage of physical layer security relies on their ability to be combined with other security schemes from higher layers.

Due to the broadcast nature of MIMO systems, security is a critical issue. However, the constellation shaping on the desired direction introduced by a new proposed transmitter means that we have directivity at the transmitted constellation that can be employed to assure security at physical layer. Privacy is achieved since each user must know the set of coefficients associated to each BPSK component as well as the array configuration; otherwise receives useless data. Therefore, the inherent security lies on the constellation directivity, i.e., the direction in which the constellation is optimized, which can be improved by changes on coefficients' phases or using constellations that are decomposed with a higher number of BPSK components. The several cases analyzed in this speech show effectiveness of the proposed approach to implement a security scheme at physical layer level.

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