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A Novel Secure Signaling Technique for Underwater Communication Channels Based on Differential Frequency Hopping and Spinal Codes

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Abstract:

Underwater acoustic communication channels suffer from many problems, such as limited bandwidth, propagation delays, Doppler shifts, time-varying nature and multipath fading. To reduce the effect of fading and time-varying nature of the underwater communication channel, a new Differential Frequency Hopping (DFH) technique, in which the hopping sequences are derived from Spinal Codes (SPC), is used. Spinal Codes are subsets of rateless error-correcting codes. They have two main features, namely, nonlinearity due to the use of hash functions which provide secure communication and randomness due to the use of Random Number Generator functions that make the distribution of hopping frequencies almost uniform. To show the efficient performance of the presented DFH based on Spinal Codes (DFH-SPC) signaling, simulations have been performed for a short range-shallow water environment with Rayleigh multipath fading channel model, with and without Doppler shifts. The results show that the performance of DFH-SPC is highly improved than the traditional DFH based on Trellis, in addition to the inherent security. © 2017 IEEE.