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## Optimal Relay Antenna Location in Indoor Environment Using Particle Swarm Optimizer and Genetic Algorithm

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**Abstract** An optimization procedure for the location of the relay transceiver in ultra-wideband wireless communication system is presented. The impulse responses of different transceiver locations are computed by shooting and bouncing ray/image (SBR/Image) techniques and inverse fast Fourier transform (IFFT). By using the impulse responses of these multi-path channels, the bit error rate (BER) performance for binary pulse amplitude modulation (BPAM) impulse radio UWB communication system are calculated. Based on the BER performance, the outage probability for any given relay location of the transceiver can be computed. The optimal relay antenna location for minimizing the outage probability is searched by genetic algorithm (GA) and particle swarm optimizer (PSO). The transmitter is in the center of the whole indoor environment and the receivers are uniform distributed with 1.5 meter intervals in the whole indoor environment. Two cases are considered as following: (I) Two relay transceivers with two different cases are employed. First, the whole space is divided into two areas and one relay transceiver is used in each area. The optimal relay antenna locations are searched in each area respectively. Second, the two optimal relay locations are searched in the whole space directly without any prior division. (II) Four relay transceivers with two different cases are employed. First, the whole space is divided into four areas and one relay transceiver is used in each area. The optimal relay antenna locations are searched in each area respectively. Second, the four optimal relay locations are searched in the whole space directly without any prior division. Numerical results have shown that our proposed method is effective for finding the optimal location for relay antenna to reduce BER and outage probability.

**Keywords** PSO · GA · BER · Outage probability · SBR/image

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