

MODELING OF PHASE-CONJUGATING ARRAYS FOR MULTI-PATH COMPENSATION IN A MARITIME ENVIRONMENT

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Unmanned Surface Vehicles (USVs) are increasingly used in high-risk intelligence, surveillance, and reconnaissance missions. Mission success is dependent largely upon maintaining a reliable communications link between the USV and the controller. However, in maritime communications, multipath fading due to reflections off the ocean surface can disrupt the link, potentially causing a loss of contact with the USV.

In this work, we use ray-tracing methods to model the potential use of phase-conjugating arrays to compensate for multipath fading and signal level variation in maritime communications. The work is based on a previously reported method in which up to 30 dB of improvement in signal-level variation was experimentally observed in a simulated severe-multipath environment (J. Tuovinen, G. S. Shiroma, W. E. Forsyth, and W. A. Shiroma, *2003 IEEE MTT-S Int. Microwave Symp. Dig.*, pp. 1681-1684, June 2003). The method does not eliminate multipath, but uses it advantageously in conjunction with a phase-conjugating array to eliminate deep fades.

Modifications to the canonical two-ray ground-reflection model were made using both a planar and sinusoidal seawater boundary. Results were first obtained for communications between omnidirectional antennas as a baseline, and then with an omnidirectional-to-phase-conjugating antenna link. The resulting model can be used to determine the minimum requirements, such as the number of array elements, for reliable communication for a given range. Since phase conjugation cannot compensate for the time delay of the data traveling on the direct path and multipath, the model is also used to analyze how the difference in path lengths affects the maximum data rate.

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2. B - Fields and Waves
3. (a)
4. C - Contributed Paper
5. There are two antenna papers being submitted by Univ. of Hawaii (shiroma8850 and shiroma8975). If possible, please schedule both papers in the same session, or at least on the same day. Due to travel schedule, our group unfortunately cannot stay at the conference the entire week.