

Multipath Arrival Tracking for Marine Vehicles Utilizing Pattern Recognition

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In recent years, interest in the Arctic Region has been steadily growing as it has become more accessible due to continued ice recession. This increased accessibility opens up the possibility for nations to take advantage of the region's abundant resources and trade routes thereby increasing military, political, and commercial interest. The extreme temperatures and significant ice cover in this region have created a unique and challenging acoustic environment. At increased distances, individual acoustic ray path data becomes inconsistent due to improper ray path identification and fading. Marine vehicles have the ability to overcome these challenges and increase contact tracking capabilities by taking advantage of the patterns associated with these multipath arrivals.

Through the use of pattern recognition, a multipath arrival tracking algorithm was developed to utilize the unique characteristics associated with each individual ray path for long range tracking purposes. This tracking algorithm analyzes the amplitude and arrival time patterns amongst all individual ray paths in order to accurately identify each ray path as scattering and fading occurs, thereby increasing range-tracking capabilities. This becomes especially useful in the Arctic Region as contacts of interest can be tracked regardless of their position above, below, or within the Beaufort Duct- a newly discovered sound duct from 100 to 200 meters depth. Simulations covering the numerous depth combinations of sources and receivers with respect to the Beaufort Duct illustrate the difficulty in contact tracking within this harsh environment and highlight the effectiveness that is presented by utilizing multipath arrival data. The developed algorithm takes advantage of these unique patterns in order to provide a unique tracking capability for marine vehicles to employ.

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