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Parallel implementation of underwater acoustic wave propagation using beamtracing method on graphical processing unit

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Abstract

The mathematical modeling of the acoustic wave propagation in seawater is the basis for realizing goals such as, underwater communication, seabed mapping, advanced fishing, oil and gas exploration, marine meteorology, positioning and explore the unknown targets within the water. However, due to the existence of various physical phenomena in the water environment and the various conditions governing the sea environment, such as, noise, sea state, depth, substrate, temperature and salinity, various methods have been proposed for the propagation of acoustic wave, which results in a high computational complexity in the numerical solution of acoustic wave propagation. Since the high speed of computing is a key factor in most real-time applications, in this study, a parallel algorithm for the implementation of computerized underwater acoustic wave propagation is presented, using the Gaussian Beamtracing method. In order to compare the performance of the proposed parallel algorithm with respect to the serial mode, the results are reported in figure and table for several different scenarios. The simulation results indicate a much higher rate of parallel algorithm than the serial mode despite its very precise accuracy.

Keywords: Underwater acoustic wave propagation, Helmholtz equation, Ray tracing method, Beamtracing method, Parallel computations.

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