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GAUSSIAN BEAMS AND 3-D BOTTOM INTERACTING ACOUSTIC SYSTEMS

Homer P. Bucker and Michael B. Porter*

U.S. Naval Ocean Systems Center, Code 541

San Diego, California 92152

ABSTRACT

The analysis of the performance of current array systems requires accurate propagation modeling. In addition, future signal processing algorithms may incorporate a propagation model in order to obtain improved target tracking. The acoustic field received at an array of sensors located on or near the ocean bottom is strongly affected by the local bathymetry and by the physical properties of the ocean subbottom. At very low frequencies, the acoustic field may even be affected by the physical properties of the basement underlying the top sediment layers. This paper describes two techniques based on Gaussian beam tracing for computing the acoustic field in such an environment. The first method employs empirically derived formulas governing the spread of the beams and has the advantage of great simplicity. In the second method the beam curvature and width are obtained formally from an ordinary differential equation along the central ray. This latter method has recently received a lot of attention in the seismological community. Both methods are free of the difficulties at caustics and in shadow zones which afflict standard ray tracing algorithms. Comparisons are presented between the standard ray tracing, simplified beam tracing, formal beam tracing and the exact solution for a difficult negative sound speed gradient problem previously examined by Pedersen and Gordon. Finally, a detection system is proposed that employs Gaussian beam tracing convolved with target tracking.

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* Now at the Naval Research Laboratory, Washington, D.C. 20375.