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the Boundary Element Method to Three-Dimensional Acoustic Propagation Problems in the Ocean

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Recently, some efforts have been made to apply the Boundary Element Method (BEM) to propagation problems in shallow waters, motivated by its neat mathematical formulation and the fact that, unlike other 3-D methods, only 2-D boundary integration is required. However, its chances of becoming a real competitor in the area are undermined by the large sizes of the discretized computational boundaries and by the inhomogeneities in the wave equation resulting from the non-uniform sound speeds that any realistic ocean description requires. Here, we present and discuss results concerning a BEM formulation aimed at predicting sound propagation in an ocean environment of arbitrary bathymetry. A marching scheme is considered so that only a fraction of the total computational domain (the bathymetry) needs to be handled at once thus providing an affordable way to tackle long range propagation problems. The parameters required for an appropriate domain partition crucially depend on the features of the bathymetry, involving in general an irregular step size. Additionally, a set of theoretical integral equations are presented that take into account the sound speed inhomogeneities by using surface and volume potentials. Finally, the numerical schemes obtained from this theoretical formulation are shown, as well as some implementation details.

Promotional text

3-D underwater sound propagation modelling allows a panoply of physical effects to be taken into account at expense of computational resources. New approaches are expected to provide insight on to handle such burden, thus facilitating efficient underwater propagation modelling.

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pre-recorded video

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