An efficient computational model for water wave propagation in coastal regions

Oliveira, F.S.B.F. and Anastasiou, K.

Applied Ocean Research, Vol. 20, No.5, pp 263-271 (1998).

Summary

An efficient numerical model of the mild-slope equation, describing water wave propagation (combined refraction-diffraction), based on robust iterative methods is presented. The elliptic formulation (boundary value problem) of the governing equation is selected for numerical treatment because it is particularly suited to complex wave fields like those encountered inside harbours. The requirement that the computational model be capable of dealing with large problem domains is addressed by implementing and testing two iterative solvers, both belonging to the family of Krylov subspace methods. The two solvers are based on the Stabilised Bi-Conjugate Gradient Method (Bi-CGSTAB) and the Generalised Minimum Residual (GMRES) method. The performance characteristics of the solvers are established using results for two standard test cases widely used as benchmarks in coastal modelling. It is shown that the Bi-CGSTAB algorithm has a considerably better convergence rate than the GMRES algorithm and, moreover, it is faster and more efficient than other published methods for the same problem.