Electronic Transactions on Numerical Analysis.
Volume 6, pp. 162-181, December 1997.
Copyright © 1997, Kent State University.
ISSN 1068-9613.

ETNA
Kent State University
etna@mcs.kent.edu

WAVE-RAY MULTIGRID METHOD FOR STANDING WAVE EQUATIONS*

A. BRANDT† AND I. LIVSHITS†

Abstract. Multigrid methods are known for their high efficiency in the solution of definite elliptic problems. However, difficulties that appear in highly indefinite problems, such as standing wave equations, cause a total loss of efficiency in the standard multigrid solver. The aim of this paper is to isolate these difficulties, analyze them, suggest how to deal with them, and then test the suggestions with numerical experiments. The modified multigrid methods introduced here exhibit the same high convergence rates as usually obtained for definite elliptic problems, for nearly the same cost. They also yield a very efficient treatment of the radiation boundary conditions.

Key words. Helmholtz equations, multigrid methods, wave-ray approach, radiation boundary conditions.

AMS subject classifications. 65N55, 65N06, 65N22, 65B99.

* Received May 16, 1997. Accepted August 1, 1997. Communicated by J. Dendy.
† Weizmann Institute of Science, Rehovot 76100, Israel.