

*Wave Propagation Around a Convex Cylinder**

ERICH ZAUDERER

Communicated by J. B. KELLER

1. Introduction. The problem of the diffraction of time harmonic waves by smooth convex objects of any shape has recently been solved by means of asymptotic expansions with respect to frequency as the frequency tends to infinity. Thus, these expansions are useful for high frequency or short wavelength problems. It has been found that these expansions have different forms in the illuminated region, the shadow region and the region near the shadow boundary resulting from the incident wave.

For two dimensional problems, which we shall consider exclusively in this work, the asymptotic expansion of the total field in the illuminated region has been obtained as a sum of the expansions of the given incident field and the resulting reflected field by Keller, Lewis and Seckler [1]. In the shadow region Keller's geometrical theory of diffraction [2] yields the asymptotic form of the field except near the surface of the object. The method of Wu and Seshadri [3] and also that of Levy and Keller [4] both of which are closely related to the geometrical theory of diffraction, give the asymptotic expansion of the field everywhere in the shadow region, including the vicinity of the body surface. However, both shadow region solutions are not valid near the point of diffraction, where the shadow boundary meets the diffracting surface. Therefore, those methods cannot relate the amplitude of the incident field to the shadow region expansion and, as a result, certain constants in each term of the field expansion remain undetermined. These constants are determined by Keller's method and therefore by combining it with the method of Wu and Seshadri or that of Levy and Keller the expansions can be completely determined throughout the shadow region. Nevertheless these expansions do not apply near the point of diffraction nor near the shadow boundary. Furthermore, they rely on the heuristic considerations of Keller's theory.

Near the point of diffraction P , a special analysis is required to determine the field. The geometrical optics method [1] fails there because the incident and

* The research reported in this paper was sponsored by the Air Force Cambridge Research Laboratories, Office of Aerospace Research, under Contract No. AF 19(604)5238. Reproduction in whole or in part is permitted for any purposes of the U. S. Government.