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The first main area of work addresses the problem of high frequency scattering from flat objects. A new formalism, developed by Dashen and Wurmser, is applied to the two-dimensional problem of scattering from a soft infinite strip. It is seen that the cross-section can be related to a quantity, termed the divergence coefficient, which describes the behavior of the field near the edges. A simple expression for the divergence coefficient and the scattering cross-section is derived which, in contrast to traditional results, is uniformly valid in the high frequency limit. The basic procedure is to first express the divergence coefficient in a series form involving Mathieu functions, approximating the terms in this series by their uniform WKB representation, and using the Poisson sum formula to convert the WKB-based series to a more rapidly converging series of integrals which can be evaluated asymptotically. The result is a new expression for the scattering cross-section which is compared with previously obtained results.

The second area addresses a specific problem in the field of wave propagation in random media: computing the average field for the case of a plane wave incident on a region with a weakly fluctuating sound speed. A review of the existing mathematical methods for treating this problem in both the small and large-scale fluctuation cases is given. In the small-scale regime, previously unrecognized problems with the closure theory are discussed and numerical results are given which illustrate the role played by backscattering in this type of propagation. In the large-scale regime, a new mathematical approach, analogous to the renormalization technique, is described and used to derive a new expression for the mean field valid in this limit. This result was systematically compared with the traditional expressions for this quantity.

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Significant progress on two research problems was made. First, a new formalism for high frequency scattering from flat objects, was applied to high frequency scattering from a soft infinite strip. A new result for the scattering cross section was obtained. Second, progress was made on the classic problem of a plane wave incident on a random medium. A new mathematical approach was used to derive an expression valid for the mean field valid in the large-scale regime.

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