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RESEARCH ON THE INVERSE PROBLEM OF SCATTERING

Harry E. Moses

University of Lowell  
Center for Atmospheric Research  
450 Aiken Street  
Lowell, Massachusetts 01854

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## 1.0 RESEARCH DIRECTIONS

In addition to continuing the directions indicated in the previous annual report, we have gone back to our interest in the linear filter. As indicated in earlier reports this equation, sometimes called the Kalman filter equation, is identical to the Gelfand-Levitan equation of inverse scattering theory. We have shown how the filter equation can be solved in terms of a comparison filter and given group-like relations between filters. A paper reporting the results has been accepted for publication.

A second area of interest is the phase retrieval problem. The solution of this problem is important in imaging problems associated with speckle interferometry, tomography and other areas. We have obtained a much simpler algorithm than used heretofore. Moreover, unlike most previous algorithms, can be extended readily to two dimensions. The results of this research will also appear as a publication.

## 2.0 INTERACTIONS WITH OTHER SCIENTISTS

The author has continued his collaboration with Prof. J. M. Cohen of the University of Pennsylvania and Prof. R. T. Prosser of Dartmouth College. He has also given invited papers at the Spring Meeting of the SPIE in Washington and at a NATO inverse seminar in Germany in September 1983. He has continued to attend and participate in a seminar at Massachusetts Institute of Technology.

### 3.0 PUBLICATIONS AND PAPERS WHICH HAVE BEEN

#### ACCEPTED FOR PUBLICATION

1. "Example of Two Distinct Potentials Without Point Eigenvalues Which Have the Scattering Operator With the Reflection Coefficient  $c(0) = -1$ ," Phys. Rev. A 27, 2220 (1983).
2. "Parity-Dependent Potentials for the One-Dimensional Schroedinger Equation Obtained From Inverse Spectral Theory" (with P. B. Abraham and B. DeFacio), J. Phys. A, 16, 303 (1983).
3. "The Gelfand-Levitan Equation on the Finite Interval" (with R. T. Prosser), J. Math. Phys., 24, 2146 (1983).
4. "Conditions for the Uniqueness of Phases and Correlation Functions in Wave Propagation," Proceedings of SPIE, Vol. 413, Inverse Optics, A. J. Devaney, Editor (1983).
5. "The Use of Comparison Filters in Linear Filter Theory," J. Math. Phys. (in press).
6. "Phases of Complex Functions from the Amplitudes of the Functions and the Amplitudes of the Fourier and Mellin Transforms" (with R. T. Prosser), J. Opt. Soc. Am. (in press).
7. "A Solution of the Time-Dependent Inverse Source Problem for Three-Dimensional Electromagnetic Wave Propagation," Proceedings NATO-Advance Research Workshop on Inverse Methods of Electromagnetic Imaging held at Bad Windsheim, Germany, September 18-24 (1983).
8. "Eigenvalues and Eigenfunctions Associated with the Gelfand-Levitan Equation" (with R. T. Prosser), J. Math. Phys. (in press).