

Dr. Sergey V. Fridman
NorthWest Research Associates, Monterey
Research Scientist

Education

M.S. (Physics) Irkutsk State University (Irkutsk, Russia), 1975
Ph.D. (Physics and Mathematics) Institute of Solar and Terrestrial Physics (Irkutsk, Russia), 1986

Areas of Experience

Dr. Sergey V. Fridman joined NWRA in 2005. Before that he worked as a Research Physicist for ATK-Mission Research, Radar and Propagation Effects Group of the Communications and Radar Systems Sector. Dr. Fridman's work has been primarily devoted to radar signal processing and to the study of ionospheric radio propagation. He developed advanced methods for solving inverse problems of ionospheric soundings for Over-the-Horizon Radar (OTHR) geolocation applications and for general radar target detection tasks. Most recently he created a system for real time reconstruction of the three-dimensional ionosphere using data from a network of TEC receivers and ionospheric sounders. Within the SIFTER effort he set forward an inverse-problems-based approach for cleaning noisy radar data and detecting weak targets. For the CREDO effort, he developed a mathematical formalism and created software for the reconstruction of the 3-dimensional ionosphere from data collected by OTHR sounders and satellite data. Within the same effort, Dr. Fridman has developed a robust technique for fully automated processing of OTHR sounding data that included automated extraction of backscatter-sounding leading edges and vertical sounding traces with subsequent estimates of the optimum ionospheric model. Before joining Mission Research, in 1996, Dr. Fridman worked as independent consultant and was the PI of a project entitled "Improved WSBI Inversion" sponsored by AFRL. During 1993-1996 Dr. Fridman was a visiting professor at the University of Illinois in Urbana-Champaign, Wave Propagation Laboratory. He taught courses in electromagnetics and signal processing and worked on analysis and theoretical interpretation of HF fading data within a US Army funded project.

Dr. Sergey Fridman is an expert reviewer in the fields of radio wave propagation, radar applications, and space geophysics for a number of international scientific journals (Radio Science, Annales Geophysicae, Journal of Geophysical Research, Geophysical Research Letters, IEEE Transactions on Geoscience and Remote Sensing).

- Electromagnetic propagation in randomly structured ionization (12 years experience)
- Robust methods for solution of inverse problems and ill-posed problems (13 years experience)
- Ionospheric modeling for Over-the-Horizon radar coordinate registration (16 years experience)
- VHF/UHF ionospheric propagation and scintillations (15 years experience)
- Advanced signal processing for radar (6 years)

Key Professional Accomplishments

- Set forward and contributed to development of the inverse problems-based approach to signal processing for detection of weak targets by radar (SIFTER)
- Created a robust method for ionospheric reconstruction from backscatter ionograms, vertical ionograms, TEC measurements, and other indirect data sources
- Invented a correlational method for automated detection of edges and traces on ionograms
- Developed theory of small-scale ionospheric irregularities produced by ionosphere-atmosphere interaction

Professional Memberships and Awards

American Geophysical Union
Siberian Branch of Academy of Sciences, 1986 Young Scientists Team Project Competition Award

Selected publications and reports of Dr. S. V. Fridman

“Regimes of ionospheric turbulence from fractal analysis of satellite radio signal scintillations,” *J. Atmos. Terr. Phys.*, V. 54, No 7/8, pp. 957-962, 1992.(with V. N. Zvezdin)

“The plasma sheet as a shock wave: geophysical consequences of the hypothesis,” *J. Geophys. Res.*, V. 98, No. 1, p. 143, 1993 (with E. V. Voronov)

“Spectral and dispersion characteristics of travelling Ionospheric disturbances as deduced From transionospheric sounding data,” *J. Atmos. Terr. Phys.*, V. 56, No. 11, pp. 1431-1446, 1994 (with E.L. Afraimovich and N.P. Minko)

“The two-frequency correlation function of the single path HF channel - theory and comparison with the experiment,” *Radio Science*, 30, No. 1, pp. 135-147, 1995 (with O. V. Fridman, K. H. Lin, K. C. Yeh, and S. J. Franke)

“Linear and nonlinear prediction techniques for short-term forecasting of HF fading signals,” *Radio Science*, V. 32, No. 3, pp. 989-998, 1997 (with K. C. Yeh, O. V. Fridman, and S. J. Franke)

“Reconstruction of three-dimensional ionosphere from backscatter and vertical ionograms measured by over-the-horizon radar,” *Radio Science*, V. 33, No. 4, pp. 1159-1171, 1998

“Improved WSBI Inversion,” AFRL-SN-RS-TR-1998-27, Final Technical Report, March 1998

“Automated Propagation Management and Assessment for Over-the Horizon Radar,” Final Technical Report F30602-96-C-0259, 31 August 1998 (with L. J. Nickisch and M. Hausman)

“Generalization of ionospheric tomography on diverse data sources: reconstruction of three-dimensional ionosphere from simultaneous vertical ionograms, backscatter ionograms and TEC data,” *Radio Science*, V. 36, No. 5, P. 1129-1139, 2001 (with L. J. Nickisch)

“SIFTER: Signal Inversion For Target Extraction and Registration – Coherent Processing of IQ Data,” Final Technical Report for NSWC contract F30602-00-C-0162, MRC/MRY-R-111, July 2003 (with L. J. Nickisch and Mark A. Hausman)

“SIFTER: Signal inversion for target extraction and registration,” *Radio Science*, V. 39, No. 1, RS1S34, doi:10.1029/2002RS002827, 2004 (with L. J. Nickisch)

“Real time reconstruction of the three-dimensional ionosphere using data from a network of GPS receivers,” *Radio Science*, V. 41, RS5S12, doi:10.1029/2005RS003341, 2006 (with L. J. Nickisch, Mark Aiello, and Mark A. Hausman)

“Range rate–Doppler correlation for HF propagation in traveling ionospheric disturbance environments,” *Radio Sci.*, 41, RS5S39, doi:10.1029/2005RS003358, 2006 (with L. J. Nickisch and Mark A. Hausman)

“TID Mitigation for OTH Radar and High-Fidelity HF Propagation Modeling,” Final Technical Report, NWRA-BELL-06-R318, March 2006 (with L. J. Nickisch and M. A. Hausman)

“SIFTER for CODAR,” Final Technical Report, NWRA-Bell-06-R322, May 2006 (with L. J. Nickisch and M. A. Hausman)

“Personal-computer-based system for real time reconstruction of the three-dimensional ionosphere using data from diverse sources,” *Radio Science*, 44, RS3008, doi:10.1029/2008RS004040, 2009 (with L. J. Nickisch and M. A. Hausman)

“Inversion of Backscatter Ionograms and TEC Data for Over-the-Horizon Radar,” 13th International Ionospheric Effects Symposium, Proceedings, Alexandria, VA, 2011 (with L. J. Nickisch and M. A. Hausman)