Isaac Shokair

Professional Skills

- Signal processing
- Statistical analysis of data
- Sensor data fusion
- Data-driven modeling for engineering applications
- Simulations of spectra and other statistical data
- Detection metrics and algorithm development
- Optimization methods
- Transport methods (neutral and charged particles)
- Software development (C, Fortran, C++, .NET C++/CLI, MFC and .NET Windows Forms for graphical user interfaces - working knowledge of C# and MATLAB)
- Project management

Education

- Ph.D. Engineering, University of California, Los Angeles, 1985
  - Thesis: "Theory of Second Harmonic Ion Cyclotron Radio Frequency Wave Coupling and Heating in Inhomogeneous Plasmas"
  - Minors in Applied Mathematics and Quantum Mechanics
- M.S. Nuclear Engineering, University of California, Los Angeles, 1980
- B.S. Nuclear Engineering, summa cum laude, University of California, Los Angeles, 1979

Experience

Engineering Science Solutions & Software, LLC, Livermore, CA (Aug. 2018 – present)

- Started Engineering Science Solutions & Software (ES^3) in the summer of 2018. Objective is to do contract work, consult, and conduct independent research.

Sandia National Laboratories, Livermore, CA (May 1998 – March 2018)

Principal Member of Technical Staff

- Near-Surface Surveillance in Maritime Environments using Raman scattering: Invented method of using Raman scattering from water molecules for detection of objects near water surfaces. Method avoids the complex elastic scattering near the water surface. Developed lidar model and published paper describing method.
- Radiation Detection Algorithm Development and Gamma Spectral Analysis:
  - Developed statistical data analysis methods, algorithms, and tools for radiation detection applications for Sandia's Homeland Security and Defense missions.
  - Devised metrics and algorithms and implemented methodology for optimized detection of special nuclear materials for PVT radiation portal monitors.

- Developed statistically-based clustering metrics, appropriate for gamma spectra that vary over several orders of magnitude, and used for spectral grouping studies. Developed methodology for estimation of detection performance of a spectrum in terms of detection performance of other spectra to address accessibility concerns.
- Developed method for fusion of spatial and spectral information to remove unknown variable backgrounds and detect specific spectral templates. Method can be applied to detection of embedded sources and area search.

- Conductivity Imaging: Developed circuit models to use in parametric and scaling studies of conductivity imaging using pulsed coils. Applied to problem of detection of shielded nuclear materials.
- Remote Sensing using Lidar:
  - Developed and implemented real-time spectral detection/discrimination algorithms for UV Laser Induced Fluorescence (LIF) lidar standoff detection. Participated in numerous field tests and conducted statistical data analysis for detection of effluents for nuclear nonproliferation missions.
  - Developed and implemented adaptive cloud detection algorithms using UV-elastic backscattered signals for real-time lidar detection of bio-aerosol clouds in cluttered environments.
  - Performed physics-based modeling, simulation, and analysis of UV-LIF lidar for experiment design, detection limit estimation, and performance assessment.
  - Developed method for removal of time-varying passive light backgrounds from measured spectra using principal component analysis of multi-pulse lidar data.

Sandia National Laboratories, Albuquerque, NM (October 1985 – May 1998)
Member of Technical Staff (October 1985 – June 1997)
Principal Member of Technical Staff (July 1997 – May 1998)

- Remote Sensing: Developed and implemented spectral detection analysis methods for UV-LIF and absorption lidar for detection of chemical effluents for nuclear nonproliferation missions. Developed theory for choosing the number and values of the lidar excitation wavelengths and fluorescence bands for optimized detection.
- Electron Beam Transport: Performed theoretical analysis and simulations of long pulse electron beam transport in the ion-focused regime. Conducted research and investigated methods for reducing the effects of the ion hose instability.
- Ion Beam Transport: Performed analysis and simulations of ion beam transport and focusing in low pressure gas. Investigated methods of correcting beam macro divergence to minimize beam emittance in self-pinch transport mode for light-ion ICF applications.

- Electromagnetic Launch: Conducted analysis and design studies in support of the Induction Coil Launcher program at Sandia. Performed optimization studies to maximize launcher performance and efficiency. Conducted analysis of transverse stability for the launcher system using a circuit-based perturbation method.

University of California, Los Angeles, CA (October 1979 – September 1985)
Research Assistant

- Conducted theoretical research in RF coupling and heating of inhomogeneous plasmas using ion cyclotron waves. Conducted research on improved spherical harmonic approximations for radiative transfer problems.

Professional Affiliations

Member of the American Physical Society

Recent Publications

1. I. R. Shokair, M. S. Johnson, R. L. Schmitt, and S. M. Sickafoose, "Concept for maritime near-surface surveillance using water Raman scattering," Appl. Opt. **57**, 4858-4864 (2018).
2. I. R. Shokair, "Optimal Detection of SNM Sources for PVT Radiation Portal Monitors," Sandia National Laboratories report SAND2018-1147, January 2018.
3. I. R. Shokair and D. J. Mitchell, "STR Spectral Grouping Studies," Sandia National Laboratories report SAND2018-0011, January 2018.
4. P. Marleau, D. Antonio, J. Brennan, J. Helm, and I. Shokair, "Magnetic Induction Sensors for Detecting Anomalous Shielding of Radiological and Nuclear Materials: a Feasibility Study," Sandia National Laboratories report SAND2017-0537, January 2017.
5. I. R. Shokair and R. Homan, "Classification of Background Suppression Profiles for Low Background RPM Data," Sandia National Laboratories report SAND2016-6676, July 2016.
6. I. R. Shokair and R. Homan, "Spatial Radiation Profile Characterization for Detection of Threat-like Sources," Proceedings of the 57th INMM meeting, Atlanta, GA, 2016.
7. I. R. Shokair, "Ratio Distributions for Use in Spectral Radiation Detection Algorithms," Sandia National Laboratories report SAND2014-18941, October 2014.
8. I. R. Shokair and D. Cohen, "Anomaly Detection and Optimization of Energy Windows for PVT RPM Measurements," Sandia National Laboratories report SAND2012-2941, July 2012.
9. I. R. Shokair and W. C. Johnson, "Including Shielding Effects in Application of the TPCA Method for Detection of Embedded Radiation Sources," Sandia National Laboratories report SAND2011-8282, December 2011.
10. I. R. Shokair, "Detection of Embedded Radiation Sources Using Temporal Variation of Gamma Spectral Data", Sandia National Laboratories report SAND2011-6453, 2011.