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## Alan S Willsky

Edwin Sibley Webster Professor of Electrical Engineering and Computer Science (retired)

MIT, SB, Aeronautics and Astronautics, 1969

MIT, PhD, Aeronautics and Astronautics, 1973

## BRIEF BIOGRAPHY

Professor Willsky came to LIDS (then ESL) in 1973 on joining the MIT faculty after receiving his PhD in guidance and control. His research has focused on both theoretical and applied problems in statistical signal and image processing. His early work on failure detection in dynamic systems is still widely cited and used in practice, and his more recent research on multiresolution methods for large-scale data fusion and assimilation has found application in fields including target tracking, object recognition, fusion of nontraditional data sources, oil exploration, oceanographic remote sensing, and groundwater hydrology. His book, *Signals and Systems*, co-authored with Professor Alan Oppenheim has been widely used throughout the world for more than 25 years.

## SELECTED PUBLICATIONS

### Books:

- A.V. Oppenheim and A.S. Willsky, *Signals and Systems*, Prentice-Hall, Inc., Upper Saddle River, NJ; 1st Edition, 1982 (with I.T. Young); 2nd Edition, 1996 (with S.H. Nawab); translations available in numerous languages including Chinese, Japanese, Korean, German, Thai, and Farsi (unauthorized).
- A.S. Willsky, *Digital Signal Processing and Control and Estimation Theory: Points of Tangency, Areas of Intersection, and Parallel Directions*, The MIT Press, Cambridge, Mass., 1979.

### Journal Papers:

- Willsky, A.S., “Multiresolution Statistical Models for Signal and Image Processing,” invited paper, *Proceedings of the IEEE*, Vol. 90, No. 8, Aug. 2002, pp. 1396-1458 (awarded 2004 IEEE Donald G. Fink Prize Paper Award).
- D.M. Malioutov, J. Johnson, and A.S. Willsky, “Walk-Sums and Belief Propagation in Gaussian Graphical Models,” *Journal of Machine Learning Research*, Vol. 7, Oct. 2006, pp. 2031-2064.
- J. Kim, M. Cetin, and A.S. Willsky, “Nonparametric Shape Priors for Active Contour-Based Image Segmentation,” *Signal Processing*, Vol. 87, No. 12, Dec. 2007, pp. 3021-3044 (recipient, Best Paper of the Year Award).
- M.J. Wainwright, T.S. Jaakkola, and A.S. Willsky, “MAP Estimation Via Agreement on Trees: Message Passing and Linear Programming Approaches,” *IEEE Trans. on Information Theory*, Vol. 51, No. 11, November 2005, pp. 3697-3717.

## Conference Papers:

- V. Chandrasekaran, S. Sanghavi, P.A. Parrilo, and A.S. Willsky, “Sparse and Low-Rank Matrix Decompositions,” SYSID 2009, 15th IFAC Symposium on System Identification, St. Malo, France, July 2009.
- E.B. Fox, E.B. Sudderth, M.I. Jordan, and A.S. Willsky, “Nonparametric Bayesian Learning of Switching Dynamical Systems,” NIPS 2008, Vancouver, Canada.
- E.B. Sudderth, M.J. Wainwright, and A.S. Willsky, “Loop Series and Bethe Variational Bounds in Attractive Graphical Models,” Vancouver, Canada.
- V. Tan, J.W. Fisher, III, and A.S. Willsky, “Learning Max-Weight Discriminative Forests,” ICASSP 2008, Las Vegas, Nev.

## Theses:

- A.S. Willsky, “Dynamical Systems Defined on Groups: Structural Properties and Estimation,” Ph.D. Thesis, MIT Dept. of Aeronautics and Astronautics, May 1973. Thesis Advisors: Roger W. Brockett, Wallace E. Vander Velde.

## SELECTED AWARDS

- Co-Founder and Chief Scientific Consultant, ALPHATECH, Inc. (now BAE Systems Advanced Information Technologies).
- Air Force Scientific Advisory Board, 1998-2002
- MIT Graduate Student Council Teaching Award, 1975
- 1975 Donald P. Eckman Award from the American Automatic Control Council
- Fellow, IEEE
- American Society of Civil Engineers and IEEE joint award, 1979
- IEEE Browder Thompson Memorial Prize Award, 1980
- IEEE Signal Processing Paper Award, 1986
- 1988 IEEE Control Systems Society Distinguished Member Award
- CVPR Paper Award, 2001
- United States Air Force Award for Meritorious Service, 2002
- Uncertainty in Artificial Intelligence Paper Award, 2002
- Donald G. Fink Prize Paper Award, 2004
- Doctorate Honoris Causa, Universite de Rennes I, 2005
- *Signal Processing* Best Paper Award, 2008
- 2013 SPS Society Award of the IEEE Signal Processing Society (SPS)

## SELECTED GRANTS

- Air Force Office of Sponsored Research, “Graphical, Optimization, and Learning Methods for Fusion and Exploitation in Sensing and Surveillance Systems.”
- Air Force Office of Sponsored Research, “Integrated Fusion, Performance Prediction, and Sensor Management for Automatic Target Exploitation,” MURI Grant (with Ohio State University, Boston University, University of Michigan, Florida State University)
- Army Research Office, “Heterogeneous Sensor Webs for Automated Target Recognition and Tracking in Urban Terrain,” MURI Grant (with UC Berkeley and Vanderbilt)
- MIT Lincoln Laboratory, “Decision Modeling Research Initiative”
- Shell Oil Corporation, “Probabilistic Methods for Enhanced Spatial Interpretation”

## SELECTED PATENTS

- "Method and Apparatus Using Multi-Target Tracking to Analyze Borehole Images and Produce Sets of Tracks and Dip Data," Patent # 6,226,595, May 1, 2001.
- "Bioprosthetic Method for Unified Specification of Goal State and Path of States to Goal," Patent Application, January 2005.

## COURSES TAUGHT

- 6.003: Signals and Systems
- 6.438: Algorithms for Inference and Estimation
- 6.041: Introduction to Probability



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**The Stochastic Systems Group**

Related Research:

**Classification and Dimensionality Reduction Using Geometric Level Set Methods**

**Large-Deviation Analysis for the Learning of Markov Tree Structures**

**Power Disaggregation**

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