



Center for  
Advanced  
Signal and  
Image  
Sciences

*Welcome to the*

# ***2006 CASIS Workshop***

***Lawrence Livermore National Laboratory  
November 16-17, 2006***

<http://casiss.llnl.gov>

***Sponsored by the LLNL Engineering Directorate  
Center Director: S. Azevedo, Co-Director: R. Roberts***

*This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48*

# C.A.S.I.S. Mission

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To further the advancement of signal and image processing for the sciences by providing a means to...

- Develop an open **liaison** between Signal & Image Processing groups in industry, government, university and establish a transfer of technology
- Transfer timely **technical information** through the media of invited seminars, short courses, publications, technical presentations
- Keep a **close coordination** with all LLNL groups performing research and development related to the Signal & Imaging Sciences
- Establish a **reference library** with current publications (texts, software, journals, reports, etc.) related to the Signal & Imaging Sciences

and

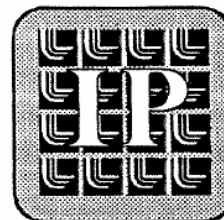
- To **sponsor** an annual CASIS Workshop at LLNL in the Signal & Image Sciences





# The fore-runner

## IMAGE PROCESSING WORKSHOP



**April 21-22, 1987**

**Lawrence Livermore National Laboratory**

**Building 481, Nova Briefing Room**

In co-operation with the EE/ME Imaging Thrust Areas  
& the Weapons Agency Non-Destructive Testing Organization (WANTO)

A workshop for LLNL, EG&G, LANL, and Sandia personnel to share ideas  
accomplishments, and areas of need in Image Processing.

Tuesday, April 21, 1987

**Welcome by Dennis K. Fisher**  
Associate Director for Engineering  
Lawrence Livermore National Laboratory

**Keynote Address by James F. Morgan**  
Lawrence Livermore National Laboratory  
**"Imaging: Why?"**  
**Current Uses of Imaging in the Nuclear Test Program**

Hosted by: Jerome E. Krammen & Mark J. LaChapell

# The CASIS web site...



Center for Advanced Signal and Imaging Sciences



Information about  
2006 CASIS Workshop  
Register on-line  
Past proceedings and  
many presentations

The screenshot shows the CASIS website in a Microsoft Internet Explorer browser window. The address bar displays the URL: [http://www-dsed.llnl.gov/llnl\\_only/review/casis06/](http://www-dsed.llnl.gov/llnl_only/review/casis06/). The website header includes the Center for Advanced Signal and Image Sciences logo and navigation links for "2006 Workshop", "2006 Workshop Agenda", "Mission", and "Contact Us". The main content area features a welcome message for the 13th Annual Signal and Imaging Sciences Workshop, held from November 16-17, 2006, at the Lawrence Livermore National Laboratory. Keynote speakers listed are Dr. James Candy and Professor Sanjit Mitra. The page also provides links to view proceedings and presentations from 2005 and 2004, and links to previous workshops from 1997 to 2005. The footer contains the CASIS Home page link, a privacy and legal notice, and the UCRL-MI-131879 identifier.

<http://casis.llnl.gov>



# *The CASIS Reference Library – B141*



The CASIS Reference Library is in B141 1000-wing (East side) with a small reading area nearby.

Collection of signal and image processing books and materials

Videotapes and CASIS materials are available for checkout

Use the sign out sheet, and contact Paul Silveira (B141/R1022) to access the materials.



<http://casis.llnl.gov>

# ***C.A.S.I.S. Staff***

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Greg Suski, DAD S&T***

# **CASIS Workshop Session Chairs**

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## **Thursday, Nov 16**

***Analysis of Massive Datasets: Chandrika Kamath***

***Nondestructive Evaluation: Harry Martz***

***Imaging Methodology: Mike Moran***

## **Friday, Nov 17**

***NIF Optics Inspection: Laura Kegelmeyer***

***Model-based Signal Processing  
and Estimation: Dave Chambers***

***Image Processing & Analysis: Dave Paglieroni***

# Past CASIS Keynote Speakers

<i>Year</i>	<i>Speaker</i>	<i>Title</i>
1998	Dr. Anthony Devaney, Northeastern University	Diffraction Tomography
1998	Dr. Ronald Bracewell, Stanford University	Detection of Nonsolar Planets by Spinning Infrared
1999	Dr. Bernard Widrow, Stanford University	A Microphone Array for Hearing Aids
1999	Dr. Avi Kak, Purdue University	A Retrospective on Computer Vision Research
2000	Prof. Simon Haykin, McMaster University	Adaptive Systems for Signal Processing
2000	Dr. Christian Pichot, University of Nice	Subsurface Tomography Using Ultra-Wide Band Systems
2001	Dr. James Greenleaf, Mayo Foundation	Vibro-acoustography: Ultrasonic Imaging Without Speckle
2001	Prof. A. Paulraj, Stanford University	Multiple Input - Multiple Output (MIMO) Wireless: The New Frontier
2002	Dr. Alan Witten, University of Oklahoma	Expedition Adventure: Using Geophysics to Find Dinosaurs, Pirate Ships and Cavemen
2002	Dr. Leon Cohen, University of New York	Time-Frequency Description of Signals
2003	Dr. Thomas Budinger, UC Berkeley	Recent Advancements in Medical Imaging
2004	Prof. Alan Oppenheim, MIT	Things My Mother Never Told Me (About Signal Processing)
2004	Prof. James McClellan, Georgia Tech	Array Signal Processing for Locating Buried Objects and Tracking Moving Targets
2005	Prof. James Flanagan, Rutgers University	Natural Interfaces for Information Systems



# **“U.S. Competitiveness and the Profession of Engineering,” Dr. James Flanagan**



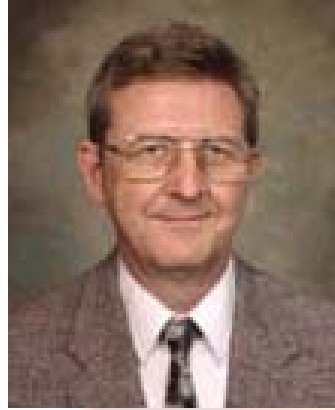
*IEEE Spectrum,*  
May 2005



*Tau Beta Pi*  
“Bent”, Fall 2006

- Our last-year’s CASIS keynote speaker wrote an article in the Fall 2006 issue of “The Bent”, international magazine of Tau Beta Pi (circ. 90,000)
- We have reprinted it in your booklet
- Timely and important article that stresses:
  - “Knowledge creation”
  - Government-funded research that drives innovation
  - Industry-University Collaboration (and labs)
  - Attracting students into science and engineering
  - Enhanced public (& congressional) awareness of physical sciences
- Technical and scientific leadership depends on these elements
- We all play a part...





***Welcome: Dr. Steven R. Patterson***  
***LLNL Associate Director for Engineering***  
***2006 CASIS Workshop***

***Lawrence Livermore National Laboratory***  
***November 16-17, 2006***

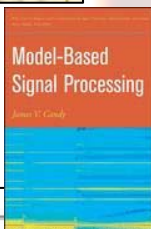




***Welcome: Dr. Edward I. Moses***  
***LLNL Associate Director for NIF***  
***2006 CASIS Workshop***

***Lawrence Livermore National Laboratory***  
***November 16-17, 2006***

# Keynote Speaker: Dr. James V. Candy



## • Biography

- B.S.E.E. from U. Cincinnati; M.S.E. & Ph.D. in EE from U. Florida
- USAF Systems Engr from 1967-71
- Researcher at LLNL since 1976; Chief Scientist for Engineering
- Adjunct Prof. at SF State, U. Santa Clara, U. C. Berkeley Ext.
- Adjunct Full-Professor at U. C. Santa Barbara

## • Awards

- Fellow of the IEEE and of the Acoustical Society of America (ASA)
- Visiting Fellow at the University of Cambridge (Clare Hall College)
- IEEE Distinguished Technical Achievement Award for “development of model-based signal processing in ocean acoustics.”
- IEEE Distinguished Lecturer for oceanic signal processing
- Presented short courses & tutorials for IEEE, ASA and SPIE

## • Publications

- Published three manuscripts:
  - "Signal Processing: the Model-Based Approach," (McGraw-Hill,1986)
  - "Signal Processing: the Modern Approach," (McGraw-Hill,1988)
  - "Model-Based Signal Processing," (Wiley/IEEE Press, 2006)
- >200 technical papers and book chapters
- Associate Editor for Signal Processing of ASA (on-line)

## • Research Interests

- Bayesian estimation, identification, spatial estimation, signal and image processing
- Array signal processing, nonlinear signal processing
- Tomography, sonar/radar processing and biomedical applications

Friday, October 28, 2005

AROUND THE LAB

### Signal processing expert begins European sabbatical

By Charlie Osoin

Even though he has worked at the Laboratory for almost 30 years and has written three textbooks on signal processing, Jim Candy hasn't lost his thirst for learning.

So when he was recently elected a visiting fellow at Cambridge University's Clare Hall College in Cambridge, UK, Candy saw the honor as "an opportunity to learn" as much as a chance to apply his own knowledge and expertise to current problems in radiation detection and counter-terrorism.

Candy, chief scientist in the Laboratory's Engineering Directorate, prepared to depart for Europe this week to begin a six-month sabbatical in the Department of Engineering Signal Processing Laboratory, where he'll do research on non-linear signal processing techniques. "I'll be focusing on radiation detection — trying to find bombs in cargo containers and the like," Candy said. "They plan to put me to work."

Candy also has been offered a six-month stint at the University of Brussels in Belgium to focus on bio-medical and ocean acoustical research, another of his specialties. Candy's innovative approach to ocean acoustics, called

Jim Candy packs up his office for his move to the UK, including the three textbooks about signal processing that he has written.

"model-based ocean acoustic signal processing," earned him the Oceanic Engineering Society's prestigious Distinguished Technical Achievement Award in 2002.

Studying and working in Europe is nothing new for Candy. He took a sabbatical at Sorbonne in Paris, the French equivalent of MIT, in 1987 and 1988 and also served a special assignment at the SAC/LANT Anti-Submarine Warfare (ASW) Center at the La Spezia Naval Base in Italy.

Candy is packing autographed copies of his textbooks to donate to the Clare Hall College library. His most recent book, "Model-Based Signal Processing," has just been published by John Wiley Inc. and the Institute of Electrical and Electronics Engineers (IEEE) Press. Candy, who founded LLNL's Center for Advanced Signal and Image Sciences (CASIS) and directed it for 10 years, was elected a fellow of IEEE in 1999. He was named a fellow of the Acoustical Society of America in 1996.

Candy has been in charge of CASIS' annual Signal and Imaging Workshop, which in recent years has attracted researchers from around the world. This year's workshop, scheduled for Nov. 17-18, will feature James Flanagan, vice president for research at Rutgers University, who recently received an IEEE Gold Medal for his work in speech and hearing processes and communications.

"I've been working to get him to a workshop for years," Candy said, "and now he's finally coming and I won't be here to hear him."





Thursday, November 16

AGENDA

Signal and Image Sciences Workshop
Center for Advanced Signal and Image Sciences
Lawrence Livermore National Laboratory

THURSDAY, NOVEMBER 16, 2006 BUILDING 482 AUDITORIUM

- 8:00 AM Registration and Continental Breakfast
8:45 AM Opening Remarks, Introductions Stephen Azevedo, CASIS Director
8:55 AM Welcome from Engineering and NIF Dr. Steven Patterson, AD Engineering, and Dr. Ed Moses, AD NIF
9:00 AM Dr. James Candy, Keynote Speaker, Chief Scientist for Engineering, LLNL; Adjunct Professor, UC Santa Barbara
A Bayesian Approach To Nonlinear Statistical Signal Processing

10:00AM MORNING BREAK—Complimentary

Analysis of Massive Datasets
Session Chair: Chandrika Kamath

- 10:30 AM Estimating Missing Features to Improve Multimedia Information Retrieval Nicole Love
10:45 AM Analysis of Rayleigh-Taylor Instability: Bubble and Spike Count Abel Gezahegne
11:00 AM Pattern Recognition for Massive, Messy Data Philip Kegelmeyer (Sandia)
11:15 AM Visualization and Analysis of 2D and 3D Image Data with VisIt Mark Miller
11:30 AM Visualization of Experimental and Numerical Data at the Sustained Spheromak Physics Experiment Carlos A. Romero-Talamás

11:45 AM LUNCH BREAK—Complimentary

Nondestructive Evaluation
Session Chair: Harry Martz

- 1:00 PM Morphological Algorithms for Non-Destructive Evaluation Siddharth Manay
1:15 PM Super-Resolution Algorithms for Ultrasonic Nondestructive Evaluation Imagery Grace A. Clark
1:30 PM Time Resolved Measurement of Transient Acoustic Waves Using a Frequency Domain Photoacoustic Microscopy System Oluwaseyi Balogun
1:45 PM Micron Scale Resolution of Structural Features in Mesoscale Material Systems Using Laser Based Acoustic Microscopy Oluwaseyi Balogun
2:00 PM Fusion of X-ray and Ultrasound Images for As-Built Modeling Grace A. Clark
2:15 PM Surface Acoustic Wave Microscopy of Optics Michael J. Quarry

2:30 PM AFTERNOON BREAK—Complimentary

Imaging Methodology
Session Chair: Mike Moran

- 3:00 PM Performance Modeling of the NIF Neutron Imaging System Carlos A. Barrera
3:15 PM Coherent Addition of Pulse for Energy (CAPE) Instrument and Data Fitting Model Study Michael Rushford
3:30 PM Curvature Wavefront Sensing Using an Extra-Focal Image and an Intra-focal Image of a Bright Star Donald Phillion
3:45 PM The Compact Compton Imager: A Spectroscopic, Large Field-of-View Gamma-Ray Camera Lucian Mihalescu
4:00 PM Distributed Object Classification in an Imaging Sensor Network Leo Szumel (UC Davis)
4:15 PM Virtual Geographic Routing Michael E. Goldsby (Sandia)

4:30 PM ADJOURN



Friday, November 17

### AGENDA

## Signal and Image Sciences Workshop Center for Advanced Signal and Image Sciences Lawrence Livermore National Laboratory

FRIDAY, NOVEMBER 17, 2006 BUILDING 482 AUDITORIUM

- 8:00 AM Registration and Continental Breakfast
- 8:50 AM Opening Remarks, Introductions ..... Randy Roberts, CASIS Co-Director
- 9:00 AM Professor Sanjit K. Mitra, Keynote Speaker, Department of Electrical Engineering–Systems,  
University of Southern California  
*Recent Research Results in Image and Video Processing*

10:00AM MORNING BREAK—Complimentary

#### NIF Optics Inspection Session Chair: Laura Kegelmeyer

- 10:30 AM NIF Optics Inspection Analysis ..... Laura Kegelmeyer
- 10:45 AM NIF Optics Damage Inspection Systems ..... Alan Conder
- 11:00 AM Parallel Image Processing for NIF Optics Inspection ..... Steve Glenn
- 11:15 AM Performance Improvements in NIF Optics Inspection Software ..... Philip Fong
- 11:30 AM Ultrasonic Shear Wave Imaging of Optic Features ..... Michael J. Quarry

11:45 AM LUNCH BREAK—Complimentary

#### Model-Based Signal Processing and Estimation Session Chair: David Chambers

- 1:00 PM Detection of Seismic Events with Model-Based Signal Processing ..... Arthur Rodgers
- 1:15 PM Model-Based Layer Estimation Using a Hybrid Genetic/Gradient  
Search Optimization Algorithm ..... David H. Chambers
- 1:30 PM Introduction to Particle Swarm Optimization ..... Sean K. Lehman
- 1:45 PM A Single-Layer Network of Unscented Kalman Filters Adaptively  
Fused by the Mixture-of-Experts Method ..... Eric Breidfeller
- 2:00 PM Measurement Uncertainty for Automatic Alignment Algorithm ..... Abdul Awwal
- 2:15 PM Spectral Analysis Options ..... Karl Nelson

2:30 PM AFTERNOON BREAK—Complimentary

#### Image Processing and Analysis Session Chair: Dave Paglieroni

- 3:00 PM Review of the State of the Art in Image Registration ..... Judy Liebman
- 3:15 PM Progressive Dense Correspondence with Applications to Video Analysis ..... Mark Duchaineau
- 3:30 PM A Linear Consolidation Approach for Automatically Extracting Roads  
of Variable Widths from Overhead Images ..... Barry Y. Chen
- 3:45 PM Algorithms for Fast, Robust Model-Based Polygon Detection ..... Siddharth Manay

4:00 PM ADJOURN

# Keynote Speaker: *Dr. Sanjit Mitra*

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- **Biography**
  - B.S. Physics from Utkal Univ. (India); M.S. Radio Physics from University of Calcutta; M.S. & Ph.D. in EE from UC Berkeley (1962)
  - Asst. Prof at Cornell 1962-65; Bell Labs 1965-67
  - Professor of EE at UC Davis until 1977
  - Professor of EE at UC Santa Barbara until 2006
  - In 2006, he moved to Viterbi School of EE at U. Southern California
- **Awards**
  - 2006 IEEE Education Medal for “outstanding contributions to electrical engineering education”
  - 2005 SPIE Technology Achievement Award
  - 2005 University Medal of Slovak Technical Univ., Bratislava
  - Member of the National Academy of Engineering
  - 2002 EURASIP Technical Achievement Award
  - 2000 IEEE Millennium Medal
  - Fellow of IEEE, AAAS, SPIE; member of EURASIP
  - President of IEEE Circuits & Systems Society in 1986
- **Publications**
  - >600 technical papers; author or co-author of 12 books; 5 patents
  - “Digital Signal Processing: A Computer Based Approach”, 3<sup>rd</sup> Ed., 2005, McGraw-Hill.
- **Research Interests**
  - Analog and digital signal processing and image processing
  - Engineering education