

# Samuel Case Bradford V, Ph.D.

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## Education

**California Institute of Technology** Pasadena, CA

2006 – Doctor of Philosophy in Civil Engineering, Minor in Seismology

Dissertation Title: Time-Frequency Analysis of Systems with Changing Dynamic Properties

Developed time-frequency representation techniques for non-stationary signals, particularly those of interest to structural health monitoring. Adapted Wigner-Ville Distribution for use in seismic and structural analysis and used modern time-frequency analysis techniques as a system identification and damage detection tool.

**California Institute of Technology** Pasadena, CA

2000 – Master of Science in Civil Engineering

**University of California at Berkeley** Berkeley, CA

1999 – Bachelor of Science in Civil & Environmental Engineering, Geotechnical Emphasis

## Work Experience

### • **Technologist** 2006 - Present

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

Advanced Deployable Structures

- Principal investigator on a two-year, \$400,000 research and technology development initiative to develop and test a meter-scale piezoelectrically-active composite reflector. Directed the development of a suite of wavefront control algorithms and associated hardware to correct thermally-induced deformations to a shape tolerance of 100 nm.
- Supported mission operations for a Mars lander.
- Technologist on a small accelerometer payload development effort to measure the deployed and deployment dynamic characteristics of a 10 m mast on-orbit.
- Developed least-squares videogrammetry tracking algorithm for deployment of an 8 m coiled-mast antenna.
- Led test campaign to characterize the dynamic and acoustic response of a 1.2 m optical segment (~\$5M test article). Developed impedance-based actuator state-of-health hardware and software system to evaluate actuator influence without requiring an optical test (this technique has since been used on five other opto-mechanical systems).
- Adapted thesis research in signal processing and time-frequency analysis to visualization of test and operational data.
- Led closeout of research and technology development initiative for construction and testing of a precision environment test enclosure and associated test article.

### • **Visitor in Aeronautics/Aerospace** 2009 - Present

California Institute of Technology, Pasadena, CA

Graduate Aerospace Laboratories (GALCIT)

- Testing of deployable structures, research and teaching assistant.

- **Graduate Student: Research Assistant, Teaching Assistant** 1999 - 2006  
California Institute of Technology, Pasadena, CA  
Department of Civil Engineering
  - Broad background in signal processing, real-time analysis of signals, finite element modeling, MATLAB, Perl, Python, shell scripting,  $\text{\LaTeX}$ , and Fortran coding.
- **Engineering Computer Facilities Manager, Systems Administrator** 2002 - 2006  
California Institute of Technology, Pasadena, CA  
Departments of Civil Engineering and Applied Mechanics
  - Developed and maintained the Caltech Online Monitoring and Evaluation Testbests (COMET) server, which provides visualization and analysis tools for seismic data.
  - Maintained research computer lab for the Caltech Civil Engineering department, in a mixed operating system environment including Windows, Linux, Unix, Macintosh.
- **Assistant Research Engineer**, University of California at San Diego Summer 1999  
Department of Structural Engineering
  - Co-authored paper on full scale test results investigating the use of stone columns around deep foundations to mitigate liquefaction effects. Tests were performed at Treasure Island in the San Francisco Bay using controlled dynamite blasting to induce liquefaction.
- **Research Assistant**, SAC Steel Project, Berkeley, CA 1998 - 1999
  - The SAC Steel Project was funded by FEMA to investigate the problem of brittle behavior of welded steel frame structures that surfaced in the January 17, 1994 Northridge Earthquake.
- **Laboratory Assistant**, University of California at Berkeley 1997 - 1998  
Water Resources Group, Department of Civil & Environmental Engineering
  - Eutrophication studies of lake and reservoir water column profiles.

## Selected Publications and Presentations

- Bradford, S.C., G.S. Agnes, C.M. Ohara, A.P. Miller and W.K. Wilkie (2011) “Active Thermal Distortion Compensation for Lightweight Composite Reflectors,” Jet Propulsion Laboratory, Research and Technology Development Poster Session.
- Bradford, S.C., G.S. Agnes, W.K. Wilkie and C.M. Ohara, (2011) “Active Thermal Distortion Compensation,” Jet Propulsion Laboratory, Research and Technology Development Annual Report.
- Bradford, S.C., G.S. Agnes and W.K. Wilkie, (2011) “An Active Composite Reflector System for Correcting Thermal Deformations,” AIAA 19th Adaptive Structures Conference (*submitted*), Denver, Colorado.
- Bradford, S.C., G.S. Agnes, A.P. Miller and W.K. Wilkie, (2011) “Shape Measurement and Control of an Active Panel under Thermal Loads,” 26th Aerospace Testing Seminar (*submitted*), Long Beach, California.
- Bradford, S.C., L. Halatek, M.D. Dolphin, M.J. Long, E. Merida, D. J. Michaels and D. A. Sigel, (2009) “A Small Payload for the Characterization of Mast Dynamics: Phaeton Early Career Hire Program,” AIAA Space 2009, Pasadena, California.
- Bradford, S.C., W.K. Wilkie and R.L. Tanimoto, (2008) “Videogrammetry Data Acquisition and Processing for a Precision Deployable Structure,” 2008 Aerospace Testing Seminar, Manhattan Beach, California.

- Bradford, S.C., G.S. Agnes, W.K. Wilkie and R.B. Williams, (2008) "Precision Deployable Structural Testing," 2008 Aerospace Testing Seminar, Manhattan Beach, California.
- Agnes, G.S., S.C. Bradford, W.K. Wilkie, R.B. Williams, R.L. Tanimoto, R. Lim and D.S. Barber, (2007) "Precision Deployable Apertures," Jet Propulsion Laboratory, Research and Technology Development poster session, October 2007 (presenting author).
- Kohler, M.D., T.H. Heaton, S.C. Bradford, (2007) "Propagating waves in the steel, moment-frame Factor Building recorded during earthquakes," Bulletin of the Seismological Society of America, Volume 97-4: pp1334-1345.
- Murphy, D.M., W.K. Wilkie, S.C. Bradford, R.L. Tanimoto and D.S. Barber, (2007) "Deployment Demonstration and Validation of SABUR: A Stable Articulating Backbone for Ultra-long Radar," American Institute of Aeronautics and Astronautics, Space 2007 Conference and Exposition, Long Beach, California (presenting author).
- Bradford, Samuel Case, (2006) "Time-Frequency Analysis of Systems with Changing Dynamic Properties," <http://resolver.caltech.edu/CaltechETD:etd-11292006-214839> Ph.D. Thesis.
- Bradford, S.C., J. Yang, T.H. Heaton, (2006) "Variations in the Dynamic Properties of Structures: the Wigner-Ville Distribution," 1906 San Francisco Earthquake Centennial Conference, San Francisco, California, April 2006 (paper and poster session).
- Clinton, J.F., S.C. Bradford, T.H. Heaton, and J. Favela, (2006) "The Observed Wander of the Natural Frequencies in a Structure," Bulletin of the Seismological Society of America, Volume 96-1: pp237-257.
- Bradford, S.C., J.F. Clinton, T.H. Heaton, (2005) "Variations in the Natural Frequencies of Millikan Library Caused by Weather and Small Earthquakes," American Society of Civil Engineers, Structures Congress, New York, April 2005.
- Bradford, S.C., T.H. Heaton, J.L. Beck, (2004) "Structural Monitoring and Evaluation Tools at Caltech: Instrumentation and Real-Time Data Analysis," Asian-Pacific Network of Centers for Earthquake Engineering Research, Young Earthquake Engineering Researchers and Professionals, Honolulu, Hawaii, July 2004.
- Bradford, S.C., J.F. Clinton, J. Favela, T.H. Heaton, (2004) "Results of Millikan Library Forced Vibration Testing," Earthquake Engineering Research Library Report: California Institute of Technology. <http://resolver.caltech.edu/CaltechEERL:EERL-2004-03>
- Ashford, S., K. Rollins, S.C. Bradford, J. Baez, (2001) "Liquefaction Mitigation Using Stone Columns Around Deep Foundations: Full Scale Test Results," Transportation Research Record No. 1736, Journal of the Transportation Research Board, pp. 110-118.

## Awards and Honors

### JPL:

- Merit Award, 2007; Team Award, 2008; Team Award, 2009; Phaeton Early Career Hire Achievement Award, 2010

### Caltech:

- Pacific Earthquake Engineering Research Center: Field Mission, July 2005, Greece
- Civil Engineering Fellowship, 1999-2006

### UC Berkeley

- Pacific Earthquake Engineering Research Center: Undergraduate Scholar
- American Society of Civil Engineers, Scholarship

- Winner (1999): Design Competition, Hearst Memorial Mining Building Retrofit Project
- National Merit Scholar

## Professional and Student Organizations

Earthquake Engineering Research Institute, Student Member: 1995-1999; American Society of Civil Engineers, Student Chapter Officer 1995-1999, Member 1999-2010; Pacific Earthquake Engineering Research Center, Student Leadership Council 1999, 2003-2006; American Institute of Aeronautics and Astronautics, Member 2006-2010.

## Computational, Laboratory, and Language Skills

- Experimental Methods  
Dynamic testing and characterization of test articles, acoustic testing, flight instrument deployment and calibration, data acquisition and telemetry systems, actuator influence functions and wavefront control via pseudo-inverse methods, electromechanical testing of active materials, signal processing and visualization of test data.
- Engineering Computer Facilities Manager, Systems Administration
  - 3+ years of systems administration and management of Engineering Computer Facilities research computer lab, including web hosting and e-mail.
  - Developed and maintained an online data management and real-time analysis system
  - Developed interface for time-frequency analysis and signal processing in Matlab
- Coding:  
Perl, Python, shell scripting, L<sup>A</sup>T<sub>E</sub>X, HTML, CSS, SQL, PHP, Fortran, MATLAB
- Operating Systems:  
Mac OS X, Linux, Solaris, Windows NT/2000/XP
- Engineering Programs (CAD, Finite Element Analysis):  
SolidWorks, ProE, AutoCAD, PATRAN/NASTRAN, I-DEAS, MATLAB/Simulink

## Teaching Experience

- Caltech Teaching Assistant (1999-2006) and Visitor (2009-present):
  - Mechanics of Materials (AM/ME 65)
  - Engineering Seismology (CE/Ge 181)
  - Vibration (AM 66)
  - Mechanics of Structures and Solids (Ae/AM/CE/ME 102abc)
  - Experimental Methods in Earthquake Engineering (CE 180)
  - Aerospace Engineering (Ae 105)
- Millikan Library Forced Vibration Demonstration and Lecture Series, Caltech, 2003-2009