

**THOMAS L. ATTARD, Ph.D.**



California State University, Fresno ◆ 2320 E. San Ramon Avenue, M/S EE94 ◆ Engineering East  
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***Education***

Ph.D. 2003. Arizona State University. Tempe, Arizona  
Department of Civil and Environmental Engineering (Structural Dynamics & Mechanics)  
Dissertation: Modeling of Higher-Mode Effects in Various Structures Using a Pushover Analysis

Master of Science 1996. Arizona State University. Tempe, Arizona  
Department of Civil and Environmental Engineering (Structural Engineering)

Bachelor of Science 1994. University of Nevada. Reno, Nevada  
Department of Civil Engineering (Civil/Structural Engineering)

***Faculty Appointments***

Assistant Professor  
Department of Civil and Geomatics Engineering, California State University, Fresno, CA [2006-present]

Courses Taught

- |  |                                   |
|--|-----------------------------------|
| • Finite Element Analysis                  | Spring 2007                       |
| • Structural Dynamics                      | Fall 2003, Fall 2004, Fall 2007   |
| • Feedback Control of Dynamical Systems    | Spring 2008                       |
| • Matrix Structural Analysis               | Fall 2005                         |
| • Inelastic Stress Analysis and Plasticity | Fall 2005                         |
| • Structural Steel Design                  | Fall 2004, Spring 2007, Fall 2007 |
| • Structural Analysis                      | Spring 2004, 2005, 2006, 2007     |
| • Mechanics of Materials                   | Fall 2007                         |
| • Statics                                  | Fall 2004, Fall 2006              |

Assistant Professor  
Department of Civil Engineering, University of New Hampshire                      Durham, NH                      [2003 – 2006]

Faculty Associate/ Teaching Associate  
Coll. of Eng./ Dept. of Civil and Env. Engineering, Arizona State University, Tempe, AZ                      [2001-2003]

***Publications***

- Attard, T., and Fafitis, A. (2005). "Plastic Hinge Development of Frame Members Using a Nonlinear Hardening Rule." *Journal of Structural Engineering*, ASCE, **131**(8), 1286-1293.
- Attard, T. (2005). "Post-Yield Material Nonlinearity: Optimal Homogeneous Shear-Frame Sections and Hysteretic Behavior," *International Journal of Solids and Structures*, **42**(21-22), 5656-5668.
- Attard, T., and Fafitis, A. (2007). "Optimal Seismic Analysis of Degrading Planar Frames using a Weighted Energy Method to Associate Inelastic Mode Shapes: Part I Optimal Parameters," *Engineering Structures*, **29**(8), 1977-1989.

- Attard, T., and Fafitis, A. (2007). "Optimal Seismic Analysis of Degrading Planar Frames using a Weighted Energy Method to Associate Inelastic Mode Shapes: Part II Application," *Engineering Structures*, **29**(8), 1990-2000.
- Attard, T. (2007). "Controlling all Inter-Story Displacements in Highly-Nonlinear Steel Buildings using Optimal Viscous Damping," *Journal of Structural Engineering*, ASCE, **133**(9), 1331 - 1340.
- Pnevmatikos, N.G.; Gantes, C.J., Attard, T.L. (2008). "Integrated Control Strategy for Structures subjected to Dynamic Loading," *Proc., Tenth Pan-American Congress of Applied Mechanics – Volume 12*, PACAM IX, Cancun, Mexico.
- Dhiradhamvit, K, Attard, T.L. (2008). "Lead-Core Base Isolation of Highly-Nonlinear Multi-Story Steel Buildings subjected to Near-Field Excitations," *Proc., Tenth Pan-American Congress of Applied Mechanics – Volume 12*, PACAM IX, Cancun, Mexico.
- Dhiradhamvit, K., and Attard, T.L. (2008). "Damage Detection and Monitoring of Highway Panels poured with a Rapid-Set<sup>®</sup> Concrete," *Proc., Tenth Pan-American Congress of Applied Mechanics – Volume 12*, PACAM IX, Cancun, Mexico.
- Attard, T.L, and Dansby, R.E. (2008). "Evolutionary Control of Damaged Systems using a Rehabilitative Algorithm," *Proc., Tenth Pan-American Congress of Applied Mechanics – Volume 12*, PACAM IX, Cancun, Mexico.
- Wesson, M.D. and Attard, T.L. (2008). "Preliminary Study: CFRP Applications for Already-Damaged Bridge-Column Bents using Experimental Shaking Table Tests," *Proc., Tenth Pan-American Congress of Applied Mechanics – Volume 12*, PACAM IX, Cancun, Mexico.
- Attard, T., Dansby, R., and Marusic, M. (2007). "Optimal Nonlinear Structural Damage Control for Kinetically Strain Hardened Systems using an Evolutionary State Transition," *ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering*, COMPDYN 2007, Rethymno, Crete, Greece.
- Dansby, R., and Attard, T., (2007). "Controlling nonlinear vibrations in steel structures using an evolutionary gain formulation to optimally satisfy performance objectives," *Sixth International Conference on Earthquake Resistant Engineering Structures*, ERES2007, Bologna, Italy. Invited Paper.
- Attard, T., and Marusic, M. (2006). "Nonlinear and Anisotropic Analysis of Multi-axially Loaded Members using a Collection of Yield Surfaces," *Proc., Ninth Pan-American Congress of Applied Mechanics – Volume 11*, PACAM IX, Merida, Mexico.
- Attard, T., and Mignolet, M. (2005). "Evolutionary Model for Random Plastic Analyses of Shear-Frame Buildings Using a Detailed Degradation Model," *9<sup>th</sup> International Conference on Structural Safety and Reliability*, ICOSSAR2005, Rome, Italy.
- Attard, T., and Fafitis, A. (2005). "Modeling of Higher-Mode Effects in Frame Buildings Using an Optimal Multi-Modal Pushover Analysis," *Fifth International Conference on Earthquake Resistant Engineering Structures*, ERES2005, Skiathos, Greece.
- Attard, T. (2004). "Optimal Damping and Higher-Mode Control in Nonlinearly Degrading Shear Buildings for a Ground Acceleration," *International Symposium on Network and*

*Center-Based Research For Smart Structures Technologies and Earthquake Engineering, SE04, Osaka, Japan.*

- Attard, T. (2004). "Post-Yield Material Analysis and Plastic Hinge Assessment of Frame Members," *Proc., Eighth Pan-American Congress of Applied Mechanics – Volume 10, PACAM VIII, Havana, Cuba.*
  - Invitation to submit a paper for a special issue in the *International Journal of Solids and Structures*
- Attard, T. (2003). "Modeling of Higher Mode Effects in Structural Frames Using a Probabilistic Nonlinear Dynamic Pushover Analysis," *Proc., 2003 ASCE/ SEI Structures Congress and Exposition, Seattle, WA.*

#### Submitted for Review or 'Under-Approved-Correction'

- Attard, T.L., and Mignolet, M. (200?). "Random Plastic Analysis using a Constitutive Model to Predict the Evolutionary Stress-Related Responses and Time Passages to Failure," *Journal of Engineering Mechanics* (under approved correction).
- Attard, T.L., and Marusic, M. (200?). "Kinematic-Isotropic based Yield Surface Collection Model for Determining the Nonlinear Anisotropic Responses in Buildings: Part I Derivation," *Engineering Structures* (submitted for review).
- Attard, T.L., and Marusic, M. (200?). "Kinematic-Isotropic based Yield Surface Collection Model for Determining the Nonlinear Anisotropic Responses in Buildings: Part II Application," *Engineering Structures* (submitted for review).

#### **Books**

- Attard, T. (2008). "Tenth Pan American Congress of Applied Mechanics," Editor, PACAM X, Volume 12, Cancun, Mexico, January 7-11, 2008.
- Attard, T. (2003). "Modeling of Higher-Mode Effects in Various Structures Using a Pushover Analysis," Doctoral Dissertation, Arizona State University, Tempe, Ariz.

#### **Computer Skills and Software Development**

Computational (Structural) Mechanics Software Development Programs

##### NONLIN

- Nonlinear Dynamic Time-History Analysis Integrated with a Constitutive Material Model that Enables Optimal MR Damper Forces to be Determined per Time-Step
  - ⇒ Local state response data is optimally controlled to meet any specified performance level
  - ⇒ Converges accurately to any number of discrete yield levels identifying the states of stress and strain during any time-step
  - ⇒ Efficiently updates velocity and acceleration response vectors using a linear rule
  - ⇒ Utilizes a Caughey-damping formulation to allow inclusion of all damped modes

##### BW-OPT

- Global Nonlinear Optimization and Bouc and Wen Parameter Computation for Random Input
  - ⇒ Includes a 4<sup>th</sup> order Runge-Kutta solver for the Bouc and Wen model

⇒ Accounts for the boundary-value conditions of each of the Bouc-Wen hysteresis legs

#### GRAB-OPT

- Optimal Control of all Modes of Vibration and Passive Damping Computation
  - ⇒ Links between NONLIN to update the damping ratios for all modes of vibration
  - ⇒ Gradient-based matrix enables all modes (and any inter-story responses) to be controlled
  - ⇒ Converges to desired performance-objectives for any (all) modes of vibration

#### PUSH-OPT

- Optimal Equivalent System Formulation in Conjunction with a Pushover Analysis for the Seismic Analysis for Frames with Higher-Mode Influence
  - ⇒ Uses the target responses computed from NONLIN to determine optimal pushover parameters for ductility, earthquake input, and inelastic modes
  - ⇒ Captures higher-mode effects and phenomena such as ratcheting, material hardening, P- $\Delta$  effects, and hysteretic energy losses

#### Other programs

- Finite Element Analysis for 2D (plane stress or plane strain) Structures
- Plane Frame/ Space Truss Structural Analysis.

#### Software Expertise and Programming Language Proficiencies

Visual Basic	MATLAB	I-DEAS (pre- and post-processor)
C	NASTRAN	Auto-CAD
FORTRAN	PATRAN	PCA-Col and PCA-Frame
PASCAL		

#### ***Sponsored Grants, Contracts, and Support***

- Nolte Engineers, “Seismic Shaking Table Tests and Investigation on Damages to Steel Water Tanks,” 2008 – 2009.
- Brooks-Ransom Engineers, “Bridge Health Monitoring and Prestress, damping, modal, and temperature losses at Hwy 180E at Temperance Ave. in Clovis, CA,” 2008 – 2009.
- Cornerstone Engineers, “Bridge Health Monitoring and Prestress, damping, modal, and temperature losses at Hwy 168 at Temperance in Clovis, CA,” 2008 – 2009.
- Efco Corporation, Arthur Alvarez, “Bent Cap Pier FormWork: A Near-Field CFRP analysis study of the 99 Overpass in Selma, CA,” 2008.
- California Department of Transportation, “Monitoring and Damage Detection in Newly-Constructed Rapid-Set Panels along Highway 99,” 2006 – 2008.
- California Department of Transportation in conjunction with California State University, Fresno, “Carbon-Wrapped Bridge Columns for Earthquake Protection,” 2006 - 2007.
- California State University, Fresno, “Soil-Structure Interaction for Earthquake Applications,” 2006 - 2007.

- National Science Foundation – Travel Grant through the University of Colorado at Boulder: NEES Fast Hybrid Test Facility, “MR Damper FHT Workshop at the Colorado NEES Facility,” Boulder, Colorado USA, 2007
- Local Engineering Industries (Brooks-Ransom Associates, C.M. Hanif Engineering, Dutcher & Associates, Advanced Structural Design, Hugo Kervorkian, Krazan and Associates, Cornerstone Engineering,” Development of the Center for Earthquake Modeling and Simulation (CEMS),” 2007.
- National Science Foundation, “Tenth Pan American Congress of Applied Mechanics - PACAM X,” 2007 – 2008
- MTS In-Kind Donation, “HSM 293.32 Purchase for Improving the Performance of the Seismic Shaking Table Facility,” 2007.
- BASF, “Carbon-Wrapping Reinforced Concrete Bridge Columns,” 2007.
- Lord Corporation, “MR Fluid Damper Application to a Structural Shear Frame under a Random Excitation,” 2004 – 2006
- ExcEEed Teaching Workshop, Fellowship, 2004
- University of New Hampshire Parents Association, “Reducing Vibrations in the Renovated Kingsbury Building Using Smart Materials,” 2004 – 2005
- University of New Hampshire International Development Program, “Smart Structures Technologies and Earthquake Engineering,” 2004
- University of New Hampshire Faculty Development, “Application of Smart Structures Technologies in Resisting Dynamic Forces,” 2003
- National Science Foundation - Travel Expense, International Symposium on Network and Center-Based Research for Smart Structures Technologies and Earthquake Engineering in Osaka, Japan, 2004
- Graduate Students Association Research Grant, Arizona State University, 2002.

### ***Workshops***

- University of Colorado at Boulder: NEES Fast Hybrid Test Facility, “MR Damper FHT Workshop at the Colorado NEES Facility,” Boulder, Colorado USA, 2007
- MR Technology Training and Workshop 2005 (Lord Corporation, N.C.)
- ExcEEed Teaching Workshop 2004 (NSF sponsored fellowship award)
- Smart Materials and Structures Technology Workshop 2004 (Honolulu, HI)

### ***Invited Research Presentations and Seminars***

- “Random Plastic Analysis of Buildings Using a Degradation Model Embedded into a Wireless Network to Compute and Control Local Constitutive Responses,” Structural

Controls Seminar, Department of Civil and Environmental Engineering, Clarkson University, Potsdam, NY, April 1<sup>st</sup>, 2005.

- “An Evolutionary Model for Plastic Analyses of Shear-Frame Buildings Using a Detailed Hardening Model and the Bouc-Wen Model,” Structural Mechanics Seminar, Department of Civil Engineering, State University of New York City College of New York, Manhattan, NY, October 30<sup>th</sup>, 2004.

### ***Professional Activities***

- North American Chairman and Editor, *11<sup>th</sup> Pan-American Congress of Applied Mechanics*, PACAM XI, Receifo, Brazil, January 4 – 8, 2010.
- Member, Scientific Committee, *11<sup>th</sup> Pan-American Congress of Applied Mechanics*, PACAM XI, Receifo, Brazil, January 4 – 8, 2010.
- Chairman and Editor, *10<sup>th</sup> Pan-American Congress of Applied Mechanics*, PACAM X, Cancun, Mexico, January 7 – 11, 2008.
- Member, Scientific Committee, *10<sup>th</sup> Pan-American Congress of Applied Mechanics*, PACAM X, Cancun, Mexico, 2008.
- Co-Chair, Technical Session on “Solid Mechanics II,” *9<sup>th</sup> Pan-American Conference of Applied Mechanics*, PACAM IX, Merida, Mexico, 2006.
- Chair, Technical Session on “Lifelines, and Monitoring and Testing,” *6<sup>th</sup> International Conference on Earthquake Resistant Engineering Structures*, ERES2007, Bologna, Italy, 2007.
- Chair, Technical Session on “Soil-Structure Interaction & Lifelines,” *5<sup>th</sup> International Conference on Earthquake Resistant Engineering Structures*, ERES2005, Skiathos, Greece, 2005.
- Member, International Science Advisory Committee (ISAC), *6<sup>th</sup> International Conference on Earthquake Resistant Engineering Structures*, ERES2007, Bologna, Italy, 2007.
- Member, International Science Advisory Committee (ISAC), *5<sup>th</sup> International Conference on Earthquake Resistant Engineering Structures*, ERES2005, Skiathos, Greece, 2005.
- Reviewer, *Journal of Applied Mechanics*, ASME, 2005-present.
- Reviewer, *International Journal of Mechanical Sciences*, 2008-present.
- Reviewer, *Structural Control and Health Monitoring*, 2008-present.
- Reviewer, *Journal of Structural Engineering*, ASCE, 2006 - Present
- Reviewer, *Journal of Systems and Control Engineering*, 2006 – Present
- Reviewer, *Journal of International Modeling and Simulations*, 2006 - Present

- Reviewer, *International Journal of Computer-Aided Civil and Infrastructure Engineering*, 2004-present.
- Reviewer, *17th Analysis and Computation Specialty Conference*, 2006 Structures Congress, ASCE Technical Committee on Structural Control, 2005.
- Member, American Society of Civil Engineers (ASCE), 2004 – present.
- Member, American Academy of Mechanics (AAM), 2006 – present.
- Panelist, National Science Foundation CAREER Award Program, Structural Systems and Hazards Mitigation of Structures, Civil & Mechanical Systems Division of the Directorate for Engineering, January 15-16, 2004.
- Panelist, UNH Undergraduate Research Opportunities Program, UNH 2004-2005.
- Member, ABET Subcommittees 1 and 2 for executing ABET-mandated guidelines, Department of Civil Engineering, University of New Hampshire, 2003-2004.
- Laboratory Safety Committee and Scribe, Department of Civil Engineering, University of New Hampshire, 2003-2005.
- Mentor, FIRST program for UNH freshman engineering students participating in the state science and robot competition, College of Engineering and Physical Sciences, University of New Hampshire, 2004.

### ***Laboratory Research Experience***

California State University, Fresno. Fresno, California

[2006-present]

Facility Coordinator and Developer of the Earthquake Testing Facility

#### Shaking Table Facility –Earthquake Modeling and Simulation

- Medium-scale earthquake simulation – one, two, and three-story buildings
- Simulated earthquake ground motions are generated using response monitoring and control (MTS Hardware)
- Structural load capacity is 40,000 pounds (at 2.2 Hz and +/- 3inches)
- Table dimensions are 8 ft x 6-3/4 ft
- Hydraulic fluid flow is monitored and compensated through a 3-stage servo-valve controller using a 100 gallon per minute pump and a single 55-kip actuator (uni-directional) with a +/- 5 inch stroke capacity

University of Nevada. Reno, Nevada

[1993-1994]

Undergraduate Research Project:

#### Seismic retrofit project of a bridge footing

- Conducted research in the seismic retrofitting of reinforced concrete bridge footings in the Engineering Research Center and laboratory
- Designed, analyzed, and constructed a footing-column test specimen that was to be tested using a hydraulic actuator and data acquisition system to generate simulated earthquake loads and record data
  - ⇒ Specimen was built to 2/5-scale of an actual bridge footing
    - \* Analyzed the system for 32k lateral (quasi-static) load and 110k gravity load
    - \* Computed the necessary lateral load to cause footing failure (one-way shear)

- \* Designed sufficient rebar to prevent column failure
- \* Designed rebar to model the in-situ bridge footing conditions
- \* Computed the necessary development length at the footing-column interface
- \* Designed the necessary strength and placement of elastomeric bearing pads to model the soil conditions under the footing
- Took bids to purchase Neoprene elastomeric bearing pads, strain gauges, rebar, concrete, etc.

### ***Other Professional Experience - Private-Sector***

The Aerospace Corporation, Spacecraft Structures Division. El Segundo, California [1997-1998]  
Projects:

#### Defense Meteorological Satellite Project (DMSP)

- Performed extensive finite element analysis on the DMSP satellite using NASTRAN and post-processed the analysis using IDEAS
- Assessed Evolved Expendable Launch Vehicle (EELV) design load factors and Delta II (coupled) loads
- Analyzed random vibration and acoustical responses for DMSP hardware, including the 40Ah and circuit housing, and the Special Sensor Microwave Imager Sounder (SSMIS).
- Analyzed a shipping container that transported the SSMIS hardware against drop height limits, buckling, and impact loading; computed the acceptable margins of safety
- Generated a small portion of the dynamic model for the DMSP S18 (SSQ) spacecraft
- Created output transformation matrices (OTMs) for the DMSP S18 (SSQ) spacecraft and assessed the resulting coupled loads against the vintage DMSP verification load cycle (VLC) and against previous static test loads

#### Global Positioning Satellite (GPS), blocks IIf and IIr

- Assessed the resonant frequency states and modes of vibration for the GPS IIf satellite under random frequency input
- Made recommendations to Air Force DoD personnel regarding critical buckling states of various components, material behavior properties, and on the accuracy of the applied loads environments
- Assessed the integrity of thermal shrouds (covering antenna structural assemblies) with low natural frequencies
- Assessed the structural integrity of the GPSIIr Satellite for newly-computed liftoff loads that were recommended because of launch pad and forcing function changes. A comparison of the results was made to those of the previous envelope and against margins of safety

#### Defense Satellite Communications System (DSCS III) Satellite

- Analyzed the DSCS satellite structure and the Integrated Apogee Boost Subsystem (IABS) structure using a revised set of liftoff loads induced by the Atlas IIA launch vehicle during separation
  - ⇒ Compared the results against the previous VLC loads envelope
  - ⇒ Computed structural margins of safety using subroutines written in FORTRAN and which were compiled using the Subdivision's MATRIX program

#### Titan IV Launch Vehicle

- Modeled the skin panels on the Titan IV using IDEAS – including the exterior skin structure, the supporting beams, and the connecting elastic spring elements
- Analyzed the panels using NASTRAN in a study to assess the panels' structural integrity when certain (proximate) failed rivet stiffeners were removed from the analysis because of over-torquing during assembly and which resulted in regions of high stress concentrations

Constantine Construction. Las Vegas, Nevada

[May - August: 1989-1991, 1995]

Job Description:

On-site construction

- Worked in framing, roofing, interior painting, and landscaping
- Poured floor slabs, and did formwork

***Affiliations/ Scholarships/ Recognition***

- 2007 ASCE Professor of the Year, 2007
- Achievement Rewards for College Scientists (ARCS) Scholarship, 2003
- Achievement Rewards for College Scientists (ARCS) Scholarship, 2002
- Outstanding Service Award, Department of Civil Engineering, University of Nevada, 1993
- President, ASCE and Associated General Contractors Student Chapters, Department of Civil Engineering, University of Nevada, 1993
- Nevada Society of Professional Engineers Scholarship (NSPE), 1990

***Collaborators***

Research Affiliations

- Jeffrey Abercrombie, Division of Structural Construction, California Department of Transportation
- Mark Der Matoian, Division Chief of Construction Central Region, California Department of Transportation
- Apostolos Fafitis, Associate Professor, Arizona State University (Graduate Advisor)
- Robert James, Construction Engineer, California Department of Transportation
- Marc Mignolet, Professor, Arizona State University
- Dusan Krajcinovic, Professor, Arizona State University
- Aditi Chattopadhyay, Professor, Arizona State University
- Michael Symans, Associate Professor, Rensselaer Polytechnic Institute
- Jerome Lynch, Assistant Professor, University of Michigan
- Jim Toscano, Global Marketing and Sales Manager, Lord Corporation, Cary, NC
- Alan Vong, Construction, California Department of Transportation

Other Affiliations

- Ayman Ababneh, Assistant Professor, Clarkson University
- Anil Agrawal, Associate Professor, The City College of the City University of New York
- Eric Hines, Research Assistant Professor, Tufts University

***Supervision of Graduate Theses***

- Marusic, M., "Multi-Axial Anisotropic Material Behavior Using a Collection of Yield Surfaces to Model the Stress-Space Coupling Phenomena," M.S. Thesis, University of New Hampshire, Defense Date: July 27, 2006.
- Bicja, J., "Post-Yield Nonlinear Behavior of Structural Steel Beam-Column Elements," M.S. Thesis, University of New Hampshire, Defense Date: July 26, 2006.

***Supervision of Undergraduate Research Projects***

- DeWaters, J., "Filling a Gap in Research and Undergraduate Education at the University of New Hampshire," Graduated May 2005.



***Current Graduate Students (Master of Science)***

- Christopher Abela
- Jan Bowen
- Robin Dansby
- Kittinun Dhiradhamvit
- Gurjot Gill
- Bryan Koeger
- Caleb Kenyon
- Saul Rico
- Michael Wesson
- Chase Wharton

***Post-Doctorate Student***

- Nikos Pnevmatikos

***Other (Personal) Information***

- Citizenship: U.S.
- Born: January 31<sup>st</sup>, 1972. Birthplace: La Mirada, California
- Sons: Constantinos (4 years old), Actaeos (6 months old)
- Passed the Fundamentals of Engineering Exam (F.E.)
- Fluent in Greek
- Former Member of the Parish Council – Greek Orthodox Church of the Annunciation (Dover, NH)