

SWAMINATHAN KRISHNAN, Ph.D., S.E.

Assistant Professor of Civil Engineering and Geophysics
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EDUCATION

Doctor of Philosophy, Civil Engineering and Business Economics & Management (Minor)
California Institute of Technology, Pasadena, CA September 2003
THESIS - Three Dimensional Nonlinear Time-History Analysis of Irregular High-Rise Buildings Subject to Strong Ground Motion

Master of Science, Civil Engineering
Rice University, Houston, TX May 1994
THESIS - System Identification of Dynamic Structural Systems Using Continuous-Time Domain Methods

Bachelor of Technology, Civil Engineering
Indian Institute of Technology, Madras, India May 1992
THESIS - Long-Span Cable Supported Bridges

RESEARCH AND PROFESSIONAL EXPERIENCE

Assistant Professor of Civil Engineering and Geophysics, California Institute of Technology January 2007 –

- Current research focus is on end-to-end simulations of fault rupture, seismic wave propagation, and structural damage. Areas of interest include computational mechanics, structural dynamics and earthquake engineering, complex structural systems, and seismology.

Consultant, ARUP Los Angeles May 2006 – Dec 2006

- Performed OSHPD review of a six-story hospital project in Temecula, California.
- Developed structural concepts for four mixed-use towers (800ft–1200ft high) in San Francisco by Renzo Piano.

Post-Doctoral Scholar, California Institute of Technology January 2004 – April 2006

- Simulated a large San Andreas fault earthquake, computed ground motions in southern California, and modeled the damage to tall steel moment-frame buildings in the entire region.

Graduate Student, California Institute of Technology September 1999 – September 2003

- Studied the damage to tall irregular buildings under strong ground motion from near-source earthquakes. Developed a nonlinear structural analysis program, FRAME3D, for this purpose.

Project Engineer, Ove Arup & Partners, Los Angeles June 1997 – December 1999

- Designed high-rise buildings in Taiwan and South Korea, and stadia in the U.S.

Project Manager, Wong Hobach Lau, Los Angeles March 1996 – May 1997

- Designed high-rise buildings in Indonesia.

Project Engineer, Kulkarni Consultants, New Orleans October 1994 – February 1996

- Designed special structures including a casino, an aquarium, and a stadium.

Graduate Student, Rice University August 1992 – June 1994

- Developed system identification techniques and tools for offshore platforms.

Undergraduate Student, Indian Institute of Technology, Madras December 1991 – April 1992

- Developed an optimal cable-net bridge system as an alternative to cable-stayed bridge systems.
- Developed software for the plastic analysis and design of steel frames.

PROFESSIONAL AFFILIATIONS AND LICENSURE

Registered Structural Engineer (SE 4768), State of California
 Registered Professional Civil Engineer (CE 58540), State of California
 Member, Earthquake Engineering Research Institute (EERI)
 Member, American Society of Civil Engineers (ASCE)
 Member, Network for Earthquake Engineering Simulation (NEES)
 Member, Consortium of Universities for Research in Earthquake Engineering (CUREE)

HONORS

Institute Fellowship, Caltech (October 2002 - September 2003)
 Robert T. & Pearl Knapp Fellowship, Caltech (October 2002 - September 2003)
 Harold-Hellwig Fellowship in Structural Engineering, Caltech (September 1999 - September 2002)
 Research Fellowship, Science & Technology Center, Rice University (January 1994 - June 1994)
 Research Fellowship, Civil Engineering Department, Rice University (August 1993 - December 1993)
 Offshore Engineering Research Scholarship, Offshore Mechanics & Arctic Engineering, ASME (1993)

INVITED PAPERS

1. Swaminathan Krishnan, "Preparing for the big one (in print)", **Monograph on Disaster Risk Management**, Council on Disaster Risk Management, American Society of Civil Engineers, 2006.

INVITED PRESENTATIONS

1. *Will the "big one" collapse our big buildings?*, September 2008, **Caltech Associates**, Regency Club, Westwood. Host: Ms. Carrie Stubstad.
2. *Will the "big one" collapse our big buildings?*, May 2008, **71st Annual Seminar Day**, California Institute of Technology. Host: Dr. Robert Gershman and Dr. Robert Burket.
3. *Preparing for the "Big One": A tall building perspective based on steel building analysis*, May 2008, **Earthquake Research Affiliates, California Institute of Technology**. Host: Ms. Margaret Vinci.
4. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, December 2007, **Structural Engineers Association of Northern California (SEAONC)**, Berkeley, California. Host: Ms. Lindsey Maclise.
5. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, November 2007, **University of California**, San Diego, California. Host: Prof. Ahmed Elgamal.
6. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, October 2007, **University of California**, Irvine, California. Host: Prof. Farzin Zareian.
7. *State of the Art 3-D Simulation Tools*, June 2007, **Network for Earthquake Engineering Simulation, 5th Annual Meeting**, Snowbird, Utah. Host: Mr. John Whitmer.
8. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, April 2007, **CEE249 Seminar, University of California**, Los Angeles, California. Host: Prof. Ertugrul Taciroglu.
9. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, January 2007, **Structural Engineers Association of Southern California (SEAOSC)**, Los Angeles, California. Host: Mr. Saif Hussain.
10. *Building Response During Large San Andreas Fault Earthquakes*, January 2007, **SoSAFE Workshop, USGS and Southern California Earthquake Center**, Los Angeles, California. Host: Dr. Ken Hudnut.
11. *Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California*, December 2006, **Seismology Committee, Structural Engineers Association of California (SEAOC)**, Sacramento, California. Host: Mr. John Diebold.
12. *Impact of a Large San Andreas Fault Earthquake on Tall Buildings in Southern California*, June 2006, **Earthquakes in Urban Areas: Joint Workshop – Southern California Earthquake Center, USA and Earthquake Research Institute, Japan**, Oxnard, California. Host: Prof. Ralph Archuleta.
13. *Impact of a Large San Andreas Fault Earthquake on Tall Buildings in Southern California*, May 2006, **AIR Worldwide Corporation**, Boston, Massachusetts. Host: Dr. Jayanta Guin.

14. *Impact of a Large San Andreas Fault Earthquake on Tall Buildings in Southern California, May 2006*, **Civil Engineering and Applied Mechanics, California Institute of Technology**. Host: Prof. John F. Hall.
15. *A Southern California-Wide End-to-End Simulation, November 2005*, **Department of Earth Sciences Seminar Series, University of Southern California**. Host: Prof. Thomas Jordan.
16. *Civil Engineering and Natural Disasters, October 26, 2005*, **The International Roundtable on "Surviving Nature's Forces: Have Civil Engineers Built Safe Communities?"**, 2005 ASCE Annual Conference, Los Angeles, California.
17. *Combining Earthquake Early Warning with Ground Motion and Building Simulations for Targeted Control of Tall Buildings, July 2005*, **Earthquake Early Warning Workshop, California Institute of Technology**. Host: Prof. Hiroo Kanamori.
18. *Impact of a M_w 7.9 Denali-like Earthquake on the San Andreas Fault on Tall Buildings in the Los Angeles Basin, February 2005*, **UCLA Seismology Seminar Series, Department of Earth and Space Sciences, University of California, Los Angeles**. Host: Prof. John Vidale.
19. *Combining Strong Motion Simulations with Building Damage Analyses to Assess the Seismic Risk to Tall Buildings in Southern California, October 2004*, **Earthquake Research Affiliates, California Institute of Technology**. Host: Ms. Margaret Vinci.
20. *Fault Rupture to Connection Fracture: Combining Strong Motion Simulations with Building Damage Analyses, October 2004*, **Dix Seismological Laboratory Seminar, California Institute of Technology**. Host: Prof. Jeroen Tromp.
21. *Fault Rupture to Connection Fracture: Combining Strong Motion Simulations with Building Damage Analyses, September 2004*, **Plenary Science Talk, 2004 Southern California Earthquake Center Annual Meeting**. Host: Prof. Thomas Jordan.
22. *Risk Posed by a Great Sumatran Earthquake to Jakarta, Singapore, and Kuala Lumpur, June 2004*, Division of Geological and Planetary Sciences, **California Institute of Technology**. Host: Prof. Kerry Sieh.
23. *Seismic Hazard Analysis of Tall Buildings in Large Cities Near Great Faults, April 2004*, Institute of Earth Science, **Academia Sinica, Taipei, Taiwan**. Host: Dr. Bor-Shouh Huang.
24. *Tall Buildings Near Great Faults - Recipe for a Disaster?, May 2003*, Department of Civil Engineering, **University of California, Los Angeles**. Host: Prof. John Wallace.
25. *Tall Buildings Near Great Faults - Recipe for a Disaster?, March 2003*, Department of Civil Engineering, **University of Missouri-Columbia**. Host: Prof. Vellore S. Gopalaratnam.
26. *Tall Buildings Near Great Faults - Recipe for a Disaster?, January 2003*, Civil Engineering Practice, **Exponent**. Host: Dr. John Osteraas.

JOURNAL PUBLICATIONS (PDF reprints available online at <http://krishnan.caltech.edu>)

1. *Krishnan, S., 2008. "3-D Modeling of Braced Steel Structures"*, Earthquake Engineering and Structural Dynamics Journal, Submitted to the Nonlinear Analysis Special Issue.
2. *Krishnan, S., 2007. "Case Studies of Damage to 19-Story Irregular Steel Moment-Frame Buildings Under Near-Source Ground Motion"*, Earthquake Engineering and Structural Dynamics Journal, Vol. 36(7), July 2007.
3. *Krishnan, S., Ji, C., Komatitsch, D., and Tromp, J., 2006. "Performance of Two 18-Story Steel Moment-Frame Buildings in Southern California During Two Large Simulated San Andreas Earthquakes"*, Earthquake Spectra, Vol. 22(4), November 2006.
4. *Krishnan, S., Ji, C., Komatitsch, D., and Tromp, J., 2006. "Case Studies of Damage to Tall Steel Moment-Frame Buildings in Southern California During Large San Andreas Earthquakes"*, Bulletin of the Seismological Society of America, Vol. 96(4), August 2006.
5. *Krishnan, S. and Hall, J. F., 2006. "Modeling Steel Frames in Three Dimensions - Part I: Panel Zone and Plastic Hinge Beam Elements"*, Journal of Engineering Mechanics, Vol. 132(4), April 2006.
6. *Krishnan, S. and Hall, J. F., 2006. "Modeling Steel Frames in Three Dimensions - Part II: Elastofiber Beam Element and Examples"*, Journal of Engineering Mechanics, Vol. 132(4), April 2006.

CONFERENCE PRESENTATIONS AND PROCEEDINGS

1. *Krishnan, S., 2008.* “Modeling steel moment frame and braced frame buildings in three dimensions using FRAME3D”, 14th World Conference on Earthquake Engineering, Beijing, China, October 2008.
2. *Krishnan, S. and Muto, M., 2008.* “Numerical Assessment of the Collapse Potential of Tall Steel Moment Frame Buildings”, Inaugural International Conference of the Engineering Mechanics Institute, University of Minnesota, May 2008.
3. *Muto, M. and Krishnan, S., 2008.* “Response of tall steel buildings in southern California to the magnitude 7.8 shakeout scenario earthquake”, Inaugural International Conference of the Engineering Mechanics Institute, University of Minnesota, May 2008.
4. *Muto, M., Krishnan, S., Beck, J. L., and Mitrani-Reiser, J., 2008.* “Seismic loss estimation based on end-to-end simulation”, IALCCE08: First International Symposium on Life-Cycle Civil Engineering, Varenna, Lake Como, Italy, 11-14 June 2008.
5. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2006.* “Simulating a Large San Andreas Fault Earthquake and Modeling Damage to Tall Buildings in Southern California”, 7th World Congress on Computational Mechanics, July 2006.
6. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2006.*, “Impact of a Large San Andreas Fault Earthquake on Tall Buildings in Southern California”, EERI’s 8th U.S. National Conference on Earthquake Engineering, April 2006.
7. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2004.* “Impact of a Large San Andreas Fault Earthquake on Tall Buildings in Southern California”, American Geophysical Union, December 2004.
8. *Conte, J. P. and Krishnan, S., 1995.* “Modal Identification Method for Structures Subjected to Unmeasured Random Excitation”, Proceedings of the 10th ASCE Engineering Mechanics Specialty Conference, Boulder, Colorado, 1995.

TECHNICAL REPORTS

1. *Krishnan, S. and Muto, M., 2008.* “SHAKEOUT 2008: Tall Steel Moment Frame Building Response”, Tech. Rep. to the US Geological Survey, 2008.
2. *Porter, K., Krishnan, S., and Xu, Xin, 2006.* “Analysis of Simultaneous Operational Failure of Critical Facilities due to Earthquake for a California Utility”, Tech. Rep. EERL 2006-01, California Institute of Technology, Pasadena, 2006.
3. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2005.* “Performance of 18-Story Steel Moment-Frame Buildings During a Large San Andreas Earthquake – A Southern California-Wide End-to-End Simulation”, Tech. Rep. EERL 2005-01 ¹, California Institute of Technology, Pasadena, 2005.
4. *Krishnan, S., 2003.* “Three Dimensional Nonlinear Analysis of Tall Irregular Steel Buildings Subject to Strong Ground Motion”, Ph.D. Thesis, Tech. Rep. EERL 2003-01 ¹, California Institute of Technology, Pasadena, 2003.
5. *Krishnan, S., 2003.* “FRAME3D - Program for Three Dimensional Nonlinear Analysis of Steel Buildings: User Guide”, Tech. Rep. EERL 2003-03 ¹, California Institute of Technology, Pasadena, 2003.
6. *Krishnan, S., 1999.*, “University of California, Davis - Seismic Assessment of Telecommunications Central Office Building”, Project No. 31211, Ove Arup and Partners, California, 1999.
7. *Krishnan, S., 1999.*, “Tzu-Chi Hall of Still Thought, Tan Tzu, Taiwan - 100% Schematic Design Structural Report”, Project No. 31203, Ove Arup and Partners, California, 1999.
8. *Krishnan, S., Zekioglu, A., and Chang, K., 1998.* “Seismic Survey of San Bernardino Valley College and Seismic Evaluation of Administration Building”, Advances in Performance Based Design - Seismic Seminar of the Ove Arup Partnership, Japan, 1998.
9. *Krishnan, S., 1998.* “San Bernardino Valley College - Seismic Evaluation of Administration Building”, Project No. 30740.95, Ove Arup and Partners, California, 1998.
10. *Krishnan, S., 1994.* “System Identification of Dynamic Structural Systems using Continuous-Time Domain Methods”, Master of Science Thesis, Rice University, 1994.
11. *Conte, J.P., Krishnan, S., and Kumar, S., 1993.* “System Identification of Offshore Platforms”, A Technical Report on Research Sponsored by Engineering Foundation, Rice University, 1993.

¹Available online at <http://krishnan.caltech.edu>

12. *Krishnan, S., 1992. "Long Span Cable Supported Bridges", Bachelor of Technology Thesis, Indian Institute of Technology, Madras, India, 1992.*

POSTERS

1. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2008. "Simulation of an 1857-like M_w 7.9 San Andreas fault earthquake and the response of tall steel moment frame buildings in southern California – A prototype study", 14th World Conference on Earthquake Engineering, Beijing, China, October 2008.*
2. *Muto, M. and Krishnan, S., 2007. "ShakeOut Scenario 2008: Performance of Tall Steel Buildings", Southern California Earthquake Center Annual Meeting 2007.*
3. *Muto, M., Heaton, T. H., Krishnan, S., and Kohler, M., 2007. "Structural Damage Detection Using Numerical Techniques: Prototype Study of the UCLA Factor Building", Southern California Earthquake Center Annual Meeting 2007.*
4. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2007. "Performance of 18-Story Steel Moment-Frame Buildings During a Large San Andreas Earthquake – A Southern California-Wide End-to-End Simulation", Pacific Earthquake Engineering Research Center Annual Meeting 2007.*
5. *Krishnan, S., Ji, S., Komatitsch, D., and Tromp, J., 2005. "Performance of 18-Story Steel Moment-Frame Buildings During a Large San Andreas Earthquake – A Southern California-Wide End-to-End Simulation", Southern California Earthquake Center Annual Meeting 2005.*

PROFESSIONAL ACTIVITIES

1. ASCE Engineering Mechanics Institute, Committee on Dynamics (2007-present).
2. Reviewer: Earthquake Engineering and Structural Dynamics, Earthquake Spectra, Engineering Structures, International Journal of Solids and Structures, Journal of Engineering Mechanics, Journal of Seismology, Journal of Structural Engineering.
3. National Science Foundation seismic proposal review panel, 2008.

TEACHING

1. 2007-08: AM/CE 151 Dynamics and Vibration.
2. 2006-07 (Partial): CE160 Structural and Earthquake Engineering.

GRANTS

1. *1857-like M_w 7.9 San Andreas fault earthquake: Response of an 18-story steel braced frame building at 636 locations in southern California*, Southern California Earthquake Center (SCEC) Award for Project #08001, 2008.
2. *SHAKEOUT 2008: Tall Steel Moment Frame Building Response*, Shakeout Scenario Earthquake Grant, Multi-Hazards Demonstration Project in Southern California, United States Geological Survey, 2007-2008.

COLLABORATORS

1. James L. Beck, California Institute of Technology.
2. John F. Hall, California Institute of Technology.
3. Thomas H. Heaton, California Institute of Technology.
4. Chen Ji, University of California, Santa Barbara.
5. Monica Kohler, University of California, Los Angeles, and California Institute of Technology.
6. Dimitri Komatitsch, University of Pau, France.
7. Judith Mitrani-Reiser, Johns Hopkins University.
8. Marco Stupazzini, Technical University of Milan.
9. Jeroen Tromp, California Institute of Technology.

MENTORING

Post Doctoral Scholars

1. Matthew Muto (2007-).

Graduate Students

1. Mohsen Chitsaz, MS (2008).
2. Gokcan Karakus, MS (2008).
3. Navneet Narayan, MS (2008).

Undergraduate Students

1. Arnar Bjorn Bjornsson (SURF 2008, University of Iceland, BS 2009)
2. Allison Saltzman (Freshman 2007-2008, BS 2011).
3. Camden Jansen (SURF 2007, BS 2010).