

Rodrigo Astroza, Ph.D.

Assistant Professor
Faculty of Engineering and Applied Sciences
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Research Interests

Structural health monitoring, Linear and nonlinear system identification, Damage identification, Experimental and operational modal analysis, Linear and nonlinear finite element model updating, Bayesian inference, Earthquake Engineering, Topographic and surface geology effects on seismic motion, Strong motion seismology.

Education

2015	University of California, San Diego – Department of Structural Engineering Postdoctoral Scholar	
2010-2015	University of California, San Diego – Department of Structural Engineering Doctor of Philosophy (Ph.D.) in Structural Engineering Dissertation: “ <i>Vibration-Based Health Monitoring and Mechanics-Based Nonlinear Finite Element Model Updating of Civil Structures</i> ” Advisor: Professor Joel P. Conte	GPA: 3.98/4.00
2014	University of California, San Diego - The Rady School of Management Micro-MBA Certificate	
2007	Universidad de Chile – Department of Civil Engineering Master of Science (M.Sc.) in Earthquake Engineering Dissertation: “ <i>Seismic Response of Buildings using Dynamic Wave Propagation</i> ” Advisor: Professor G. Rodolfo Saragoni	GPA: 7.0 / 7.0
2007	Universidad de Chile – Department of Civil Engineering Civil Engineer	GPA: 7.0 / 7.0
2003	Universidad de Chile – School of Engineering Bachelor in Engineering Sciences, Major in Civil Engineering	

Teaching Experience

- **Assistant professor:** Faculty of Engineering and Applied Sciences, Universidad de Los Andes, Chile. 01/2016 – Now.
- **Instructor.** Statics, Mechanics of Materials, Design of Reinforced Concrete, Advanced Reinforced Concrete Design. Faculty of Engineering and Applied Sciences, Universidad de Los Andes, Chile. 03/2006 – 12/2009.
- **Teaching assistant.** Calculus, Algebra, Statics, Mechanics of Solids I, Mechanics of Solids II, Design of Reinforced Concrete, Advanced Reinforced Concrete Design, Design of Prestressed Concrete. School of Engineering, Universidad de Chile. 03/2002 – 12/2005.
- **Teaching assistant.** Probability, Statistics and Reliability. Department of Structural Engineering, University of California, San Diego. (Fall 2011, Fall 2014)

Publications

Books and book chapters

- [B1] **Astroza, R.** and Saragoni, G.R. (2012). *Seismic response of buildings using dynamic wave propagation*. Lambert Academic Publishing, Saarbrücken-Germany (ISBN: 978-3-8484-7796-8) (in Spanish).

- [B2] Astroza, M., Ruiz, S., **Astroza, R.**, and Molina, J. (2012) “Seismic intensities.” Chapter 5 in *M_w=8.8 Chilean Earthquake, February 27 2010* (ISBN: 978-9-5635-1152-9) (in Spanish).
- [B3] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). “Modal identification of 5-story RC building tested on NEES-UCSD shake table.” Chapter 13 in *Topics in Dynamics of Civil Structures*, Springer (ISBN 978-1-4614-6555-3).
- [B4] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Hutchinson, T.C., and Restrepo, J.I. (2013). “Evolution of dynamic properties of a 5-story RC building during construction.” Chapter 19 in *Topics in Dynamics of Civil Structures*, Springer (ISBN 978-1-4614-6555-3).
- [B5] Ebrahimian, H., **Astroza, R.**, Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). “Pre-test nonlinear FE modeling of full-scale five-story reinforced concrete building.” Chapter 54 in *Topics in Dynamics of Civil Structures*, Springer (ISBN 978-1-4614-6555-3).
- [B6] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). “Statistical analysis of the identified modal properties of a 5-story RC seismically damaged building specimen.” In *Safety, Reliability, Risk and Life-cycle Performance of Structures and Infrastructures*, CRC Press Taylor & Francis (ISBN 978-1-1380-0086-5).
- [B7] Ebrahimian, H., **Astroza, R.**, Conte, J.P. (2015). “Nonlinear structural finite element model updating using batch Bayesian estimation.” Chapter 4 in *Model Validation and Uncertainty Quantification, Vol. 3*, Springer (ISBN 978-3-319-15223-3).
- [B8] **Astroza, R.**, Ebrahimian, H., Conte, J.P. (2015). “Nonlinear structural finite element model updating using stochastic filtering.” Chapter 7 in *Model Validation and Uncertainty Quantification, Vol. 3*, Springer (ISBN 978-3-319-15223-3).
- [B9] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2017). “Batch and Recursive Bayesian Estimation Methods for Nonlinear Structural System Identification.” Chapter 15 in *Risk and Reliability Analysis: Theory and Applications, In Honor of Prof. Armen Der Kiureghian*, 341–364, Springer (ISBN 978-3-319-52425-2).
- [B10] Conte, J.P., **Astroza, R.**, Benzoni, G., Feltrin, G., Loh, K.J., and Moaveni, B. (Eds). (2017). *Experimental Vibration Analysis of Civil Structures: Testing, Sensing, Monitoring, and Control*. Lecture Notes in Civil Engineering, Volume 5, Springer, Cham, Switzerland (ISBN 978-3-319-67442-1). <https://doi.org/10.1007/978-3-319-67443-8>

Journals

- [J1] Astroza, M., Ruiz, S., and **Astroza, R.** (2012). “Damage assessment and seismic intensity analysis of the 2010 (M_w 8.8) Maule Earthquake.” *Earthquake Spectra*, 28(S1), S145–S164. <http://dx.doi.org/10.1193/1.4000027>
- [J2] **Astroza, R.**, Pantoli, E., Selva, F., Restrepo, J.I., Hutchinson, T.C., and Conte, J.P. (2015). “Experimental evaluation of the seismic response of a roof-top mounted cooling tower.” *Earthquake Spectra*, 31(3), 1567–1589. <http://dx.doi.org/10.1193/071513EQS205M>
- [J3] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2015). “Material parameter identification in distributed plasticity FE models of frame-type structures using nonlinear stochastic filtering.” *ASCE Journal of Engineering Mechanics*, 141(5), 04014149. <http://ascelibrary.org/doi/abs/10.1061/%28ASCE%29EM.1943-7889.0000851>
- [J4] Ebrahimian, H., **Astroza, R.**, and Conte, J.P. (2015). “Extended Kalman filter for material parameter estimation in nonlinear structural finite element models using direct differentiation method.” *Earthquake Engineering & Structural Dynamics*, 44(10), 1495–1522. <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2532/abstract>
- [J5] Wang, X., **Astroza, R.**, Hutchinson, T.C., Conte, J.P., and Restrepo, J.I. (2015). “Dynamic characteristics and seismic behavior of prefabricated steel stairs in a full-scale five-story building shake table test program.” *Earthquake Engineering & Structural Dynamics*, 44(14), 2507–2527. <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2595/abstract>

- [J6] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2016). “System identification of a full-scale five-story reinforced concrete building tested on the NEES-UCSD shake table.” *Structural Control and Health Monitoring*, 23(3), 535–559. <http://onlinelibrary.wiley.com/doi/10.1002/stc.1778/abstract>
- [J7] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2016). “Influence of the construction process and nonstructural components on the modal properties of a five-story building.” *Earthquake Engineering & Structural Dynamics*, 45(7), 1063–1084. <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2695/abstract>
- [J8] Chen, M.C., Pantoli, E., Wang, X., **Astroza, R.**, Ebrahimian, H., Hutchinson, T.C., Conte, J.P., Restrepo, J.I., Marin, C., Walsh, K., Bachman, R., Hoehler, M., Englekirk, R., and Faghihi, M. (2016). “Full-scale structural and nonstructural building system performance during earthquakes: Part I – Specimen description, test protocol, and structural response.” *Earthquake Spectra*, 32(2), 737–770. <http://earthquakespectra.org/doi/abs/10.1193/012414EQS016M>
- [J9] Pantoli, E., Chen, M.C., Wang, X., **Astroza, R.**, Ebrahimian, H., Hutchinson, T.C., Conte, J.P., Restrepo, J.I., Marin, C., Walsh, K., Bachman, R., Hoehler, M., Englekirk, R., and Faghihi, M. (2016). “Full-scale structural and nonstructural building system performance during earthquakes: Part II – NCS damage states.” *Earthquake Spectra*, 32(2), 771–794. <http://earthquakespectra.org/doi/abs/10.1193/012414EQS017M>
- [J10] Pantoli, E., Chen, M.C., Hutchinson, T.C., **Astroza, R.**, Conte, J.P., Ebrahimian, H., Restrepo, J.I., and Wang, X. (2016). “Landmark dataset from the building nonstructural components and systems (BNCS) project.” *Earthquake Spectra*, 32(2), 1239–1260. <http://earthquakespectra.org/doi/abs/10.1193/100614EQS150>
- [J11] **Astroza, R.**, Nguyen, L.T., and Nestorović, T. (2016). “Finite element model updating using simulated annealing hybridized with unscented Kalman filter.” *Computers & Structures*, 177, 176–191. <http://dx.doi.org/10.1016/j.compstruc.2016.09.001>
- [J12] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and de Callafon, R.A. (2017). “Nonlinear finite element model updating for damage identification of civil structures using batch Bayesian estimation.” *Mechanical Systems and Signal Processing*, 84 Part B (Special issue on Recent Advances in Nonlinear System Identification), 194–222. <http://www.sciencedirect.com/science/article/pii/S0888327016000297>
- [J13] **Astroza, R.**, Ebrahimian, H., Li, Y., and Conte, J.P. (2017). “Bayesian nonlinear structural FE model and seismic input identification for damage assessment of civil structures.” *Mechanical Systems and Signal Processing*, 93, 661–687. <http://www.sciencedirect.com/science/article/pii/S0888327017300493>
- [J14] Wang, X., Hutchinson, T.C., **Astroza, R.**, Conte, J.P., Restrepo, J.I., Hoehler, M.S., and Ribeiro, W. (2017). “Shake table testing of an elevator system in a full-scale five-story building.” *Earthquake Engineering & Structural Dynamics*, 46(3), 391–407. <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2793/abstract>
- [J15] **Astroza, R.**, Pastén, C., and Ochoa-Cornejo, F. (2017). “Site response analysis using one-dimensional equivalent-linear analysis and Bayesian filtering.” *Computers and Geotechnics*, 89, 43–54. <http://www.sciencedirect.com/science/article/pii/S0266352X17300927>
- [J16] Chen, M.C., **Astroza, R.**, Restrepo, J.I., Conte, J.P., Hutchinson, T.C., and Bock, Y. “Predominant period and equivalent viscous damping ratio identification on a full-scale building shake table test.” *Earthquake Engineering & Structural Dynamics*, In Press, <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2913/abstract>
- [J17] Li, Y., **Astroza, R.**, and Conte, J.P. “Nonlinear FE model updating and reconstruction of the response of an instrumented seismic isolated bridge to the 2010 Maule Chile earthquake.” *Earthquake Engineering & Structural Dynamics*, In Press. <http://onlinelibrary.wiley.com/doi/10.1002/eqe.2925/abstract>.
- [J18] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Papadimitriou, C. “A nonlinear model inversion method for joint system parameter, noise, and input identification of civil structures.” *Procedia Engineering*, 199, 924–929.
- [J19] Li, Y., **Astroza, R.**, Conte, J.P., and Soto, P. “Nonlinear FE model updating of seismic isolated bridge instrumented during the 2010 Mw 8.8 Maule-Chile Earthquake.” *Procedia Engineering*, 199, 3003–3008.
- [J20] **Astroza, R.**, Gutierrez, G., Reppenning, C., and Hernández, F. “Time-variant modal parameters and response behavior of a base-isolated building tested on a shake table.” *Earthquake Spectra*, In Press. <https://doi.org/10.1193/032817EQS054M>

- [J21] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Hutchinson, T.C. “Pre-test nonlinear finite element simulation of a full scale five-story reinforced concrete building tested on the NEES-UCSD shake table.” *Accepted for publication in ASCE Journal of Structural Engineering*.
- [J22] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Papadimitriou, C. “Bayesian optimal estimation for output-only nonlinear system and damage identification of civil structures.” *Accepted for publication in Structural Control and Health Monitoring*.

Conferences

- [C1] Astroza, M., Norambuena, A., and **Astroza, R.** (2006). “Reinterpretation of the intensity data for 1906 Valparaíso earthquake.” *International Conference Montessus de Ballore 1906 Valparaíso Earthquake Centennial*, Santiago, Chile, November, 2006. (in Spanish)
- [C2] Dechent, P., Crempien, J., **Astroza, R.**, Manríquez, R., and Ormeño, R. (2007). “Seismic Waves Amplification in Regions with Irregular Topography.” *Proc. of the 6th Chilean Conference on Computational Mechanics*, Santiago, Chile, August, 2007. (in Spanish)
- [C3] **Astroza, R.** and Saragoni, G.R. (2008). “Seismic response of a reinforced concrete frame building – A dynamic wave propagation approach.” *Proc. of the 33rd Sud-American Conference in Structural Engineering*, Santiago, Chile, May 26-30, 2008. (in Spanish)
- [C4] **Astroza, R.** and Saragoni, G.R. (2008). “Determination of acceleration floor response spectrum by wave propagation approach.” *Proc. of the 33rd Sud-American Conference in Structural Engineering*, Santiago, Chile, May 26-30, 2008. (in Spanish)
- [C5] Astroza, M. and **Astroza, R.** (2008). “Comparison of the damages produced by Chilean earthquakes with different seismogenic sources.” *Proc. of the 33rd Sud-American Conference in Structural Engineering*, Santiago, Chile, May 26-30, 2008. (in Spanish)
- [C6] **Astroza, R.** and Saragoni, G.R. (2008). “Wave dynamic analysis of the seismic response of a reinforced concrete building.” *Seismic Engineering International Conference commemorating the 1908 Messina and Reggio Calabria Earthquake*, Reggio Calabria, Italy, July 8-11, 2008.
- [C7] Astroza M., Barrientos, S., and **Astroza, R.** (2008). “Damage, vulnerability and intensities generated by the November 14, 2007, Tocopilla Earthquake.” *American Geophysical Union (AGU) Joint Assembly*, Fort Lauderdale, FL, May 27-30, 2008.
- [C8] Astroza M. and **Astroza, R.** (2008). “Intensities and damage caused by major earthquakes in Chile.” *International Symposium: The Geophysics and its Contribution in Natural Disaster Reduction*, Arequipa, Peru, August 12-14, 2008. (in Spanish)
- [C9] **Astroza, R.** (2009). “Seismic response of the Tazana hill by strong motion analysis.” *Proc. of the IV Colombian Conference on Earthquake Engineering and Seismology*, Pereira, Colombia, May 13-15, 2009. (in Spanish)
- [C10] **Astroza, R.** and Valín, S. (2009). “Seismic acceleration demands on rigid nonstructural components.” *Proc. of the IX Venezuelan Conference on Earthquake Engineering and Seismology*, Caracas, Venezuela, May 19-22, 2009. (in Spanish)
- [C11] **Astroza, R.** and Kovacevic, N. (2010). “Effect of low frequency waves in seismic response of buildings.” *X Chilean Conference on Seismology and Earthquake Engineering*, Santiago, Chile, May 24-27, 2010. (in Spanish)
- [C12] **Astroza, R.** and Soto, A. (2010). “Estimation of peak floor horizontal accelerations induced by earthquakes.” *X Chilean Conference on Seismology and Earthquake Engineering*, Santiago, Chile, May 24-27, 2010. (in Spanish)
- [C13] Astroza, M. and **Astroza, R.** (2010). “Intensities and damages generated by 2007 Tocopilla Earthquake.” *X Chilean Conference on Seismology and Earthquake Engineering*, Santiago, Chile, May 24-27, 2010. (in Spanish)

- [C14] **Astroza, R.**, Dechent, P., and Crempien, J. (2010). "Effect of irregular topography on seismic amplification: case of Tarzana hill." *X Chilean Conference on Seismology and Earthquake Engineering*, Santiago, Chile, May 24-27, 2010. (in Spanish)
- [C15] Conte, J.P., Ebrahimian, H., and **Astroza, R.** (2012). "Using DIANA for nonlinear modeling and analysis of a full-scale R/C building specimen tested on the UCSD shake table." *TNO DIANA US Seminar: Numerical Analysis in Earthquake Engineering*, Berkeley, CA, May 22, 2012.
- [C16] Pantoli, E., Chen, M., **Astroza, R.**, Ebrahimian, H., Wang, X., Hutchinson, T.C., Restrepo, J.I. and Conte, J.P. (2012). "Shake table response of a fully furnished full-scale five story building." *NSF Engineering Research and Innovation Conference, Quake Summit 2012*, Boston, MA, July 9-12, 2012, Boston, MA, July 9-12, 2012.
- [C17] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Hutchinson, T.C., and Restrepo, J.I. (2012). "Dynamic characteristics of a 5-story reinforced concrete building tested on the NEES-UCSD shake table." *7th International Workshop on Advanced Smart Materials and Smart Structures Technology (ANCRiSST2012)*, Bangalore, India, July 27-28, 2012.
- [C18] Ebrahimian, H., **Astroza, R.**, Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). "Pre-test nonlinear FE modeling of full-scale five-story reinforced concrete building." *Proc. 31st International Modal Analysis Conference (IMAC XXXI)*, Garden Grove, CA, February 11-14, 2013.
- [C19] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). "Modal identification of 5-story RC building tested on NEES-UCSD shake table." *Proc. 31st International Modal Analysis Conference (IMAC XXXI)*, Garden Grove, CA, February 11-14, 2013.
- [C20] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Hutchinson, T.C., and Restrepo, J.I. (2013). "Evolution of dynamic properties of a 5-story RC building during construction." *Proc. 31st International Modal Analysis Conference (IMAC XXXI)*, Garden Grove, CA, February 11-14, 2013.
- [C21] Wang, X., Ebrahimian, H., **Astroza, R.**, Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). "Shake table testing of a full-scale five-story building: Pre-test simulation of the test building and development of the nonstructural components and systems design criteria." *2013 Structures Congress*, Pittsburgh, PA, May 2-4, 2013.
- [C22] **Astroza, R.**, Conte, J.P., Restrepo, J.I., Ebrahimian, H., and Hutchinson, T.C. (2013). "Shake table testing of a full-scale five-story building: System identification of the five-story test structure." *2013 Structures Congress*, Pittsburgh, PA, May 2-4, 2013.
- [C23] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2013). "Statistical analysis of the identified modal properties of a 5-story RC seismically damaged building specimen." *Proc. of the 11th International Conference on Structural Safety and Reliability (ICOSSAR'13)*, New York, NY, June 16-20, 2013.
- [C24] Chen, M.C., **Astroza, R.**, Pantoli, E., Hutchinson, T.C., Restrepo, J.I., Conte, J.P., and Bachman, R. (2013). "Seismic performance of a full-scale five-story building shake table tested in a base-isolated and fixed-base configuration." In: Adam, C., Heuer, R., Lenhardt, W., and Schranz, C. (eds), *Proc. Vienna Congress on Recent Advances in Earthquake Engineering and Structural Dynamics (VEESD 2013)*, Vienna, Austria, August 28-30, 2013.
- [C25] Wang, X., **Astroza, R.**, Pantoli, E., Hutchinson, T.C., and Conte, J.P. (2013). "Experimental evaluation of the seismic performance of egress systems in a full-scale five-story building." In: Adam, C., Heuer, R., Lenhardt, W., and Schranz, C. (eds), *Proc. Vienna Congress on Recent Advances in Earthquake Engineering and Structural Dynamics (VEESD 2013)*, Vienna, Austria, August 28-30, 2013.
- [C26] **Astroza, R.**, Conte, J.P., Ebrahimian, H., Restrepo, J.I. and Hutchinson, T.C. (2013). "Modal identification of a full-scale 5-story reinforced concrete building tested on the NEES-UCSD shake table." *Proc. 5th International Conference Experimental Vibration Analysis for Civil Engineering Structures (EVACES'13)*, Ouro Preto, Brazil, October 28-30, 2013.

- [C27] **Astroza, R.**, Conte, J.P., Ebrahimian, H., Restrepo, J.I, and Hutchinson, T.C. (2013). “System identification of a 5-story RC building during construction.” *Proc. 5th International Conference Experimental Vibration Analysis for Civil Engineering Structures (EVACES’13)*, Ouro Preto, Brazil, October 28-30, 2013.
- [C28] Ebrahimian, H., **Astroza, R.**, Conte, J.P., Restrepo, J.I, and Hutchinson, T.C. (2014). “Experimental validation of dynamic nonlinear FE model of full-scale five-story reinforced concrete building.” *Proc. 9th International Conference on Structural Dynamics (EURODYN 2014)*, Porto, Portugal, June 30-July 2, 2014.
- [C29] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I, and Hutchinson, T.C. (2014). “System identification of a full-scale five-story reinforced concrete building tested on the NEES-UCSD shake table.” *Proc. 9th International Conference on Structural Dynamics (EURODYN 2014)*, Porto, Portugal, June 30-July 2, 2014.
- [C30] Wang, X., **Astroza, R.**, Hutchinson, T.C., Conte, J.P., and Bachman, R. (2014). “Seismic demands on acceleration-sensitive nonstructural components using recorded building response data – Case study.” *Proc. 10th National Conference in Earthquake Engineering (10NCEE)*, Anchorage, AK, July 21-25, 2014.
- [C31] Ebrahimian, H., **Astroza, R.**, and Conte, J.P. (2015). “Nonlinear structural finite element model updating using batch Bayesian estimation.” *Proc. 33rd International Modal Analysis Conference (IMAC XXXIII)*, Orlando, FL, February 2-5, 2015.
- [C32] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2015). “Nonlinear structural finite element model updating using stochastic filtering.” *Proc. 33rd International Modal Analysis Conference (IMAC XXXIII)*, Orlando, FL, February 2-5, 2015.
- [C33] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2015). “Stochastic filtering for damage identification through nonlinear structural finite element model updating.” *Proc. SPIE conference on Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, San Diego, CA, March 8-12, 2015.
- [C34] Ebrahimian, H., **Astroza, R.**, and Conte, J.P. (2015). “Output-only identification of civil structures using nonlinear finite element model updating.” *Proc. SPIE conference on Health Monitoring of Structural and Biological Systems IX*, San Diego, CA, March 8-12, 2015.
- [C35] Ebrahimian, H., **Astroza, R.**, and Conte, J.P. (2015). “Nonlinear structural finite element model updating and uncertainty quantification.” *Proc. SPIE conference on Structural Health Monitoring and Inspection of Advanced Materials, Aerospace, and Civil Infrastructure IX*, San Diego, CA, March 8-12, 2015.
- [C36] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2015). “Blind identification of nonlinear civil structures using sparse seismic response data.” *Proc. Engineering Mechanics Institute Conference*, Stanford University, CA, June 16-19, 2015.
- [C37] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2015). “Material parameter estimation in distributed plasticity FE models using the unscented Kalman filter.” *Proc. 12th International Conference on Applications of Statistics and Probability in Civil Engineering, ICASP12*, Vancouver, Canada, July 12-15, 2015.
- [C38] Conte, J.P., **Astroza, R.**, and Ebrahimian, H. (2015). “Bayesian methods for nonlinear system identification of civil structures.” *Proc. 6th International Conference Experimental Vibration Analysis for Civil Engineering Structures (EVACES’15)*, Dübendorf, Switzerland, October 19-21, 2015.
- [C39] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2016). “Bayesian methods for nonlinear finite element model updating and damage identification of civil structures.” *Proc. Engineering Mechanics Institute Conference*, Vanderbilt University, TN, May 22-25, 2016. **Keynote in mini-symposium EMI-MS-01: Structural Identification and Damage Detection.**
- [C40] Li, Y., **Astroza, R.**, and Conte, J.P. (2016). “Nonlinear finite element model updating and seismic response reconstruction of Marga-Marga Bridge during the Mw 8.8 Maule, Chile Earthquake.” *Proc. Engineering Mechanics Institute Conference*, Vanderbilt University, CA, May 22-25, 2016.
- [C41] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Bitmead, R.R. (2016). “Identifiability assessment of nonlinear structural system identification problems.” *Proc. Engineering Mechanics Institute Conference*, Vanderbilt University, CA, May 22-25, 2016.

- [C42] **Astroza, R.**, Ebrahimian, H., and Conte, J.P. (2017). “Seismic structural health monitoring using Bayesian methods and nonlinear structural finite element models.” *Proc. 16th World Conference on Earthquake Engineering*, Santiago, Chile, January 22-25, 2017.
- [C43] Li, Y., **Astroza, R.**, and Conte, J.P. (2017). “Investigation of seismic isolation for California high-speed rail prototype bridge in the context of probabilistic performance-based optimum seismic design.” *Proc. 16th World Conference on Earthquake Engineering*, Santiago, Chile, January 9-13, 2017.
- [C44] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Papadimitriou, C. (2017). “Bayesian inference method for blind nonlinear system and damage identification of civil structures.” *Proc. 35th International Modal Analysis Conference (IMAC XXXV)*, Garden Grove, CA, Jan.30-Feb. 2, 2017.
- [C45] Conte, J.P., **Astroza, R.**, and Ebrahimian, H. (2017). “Nonlinear finite element model updating and damage identification of civil structures using Bayesian methods” *Proc. 35th International Modal Analysis Conference (IMAC XXXV)*, Garden Grove, CA, Jan.30-Feb. 2, 2017. *Invited Tutorial Session*.
- [C46] **Astroza, R.**, Gutierrez, G., Repenning, C., and Hernandez, F. (2017). “System identification of a base-isolated building using seismic data.” *Proc. 7th International Conference Experimental Vibration Analysis for Civil Engineering Structures (EVACES2017)*, San Diego, CA, July 12-14, 2017.
- [C47] **Astroza, R.**, Alessandri, A., Conte, J.P. (2017). “Nonlinear finite element model parameter estimation including modeling errors.” *Proc. 7th International Conference Experimental Vibration Analysis for Civil Engineering Structures (EVACES2017)*, San Diego, CA, July 12-14, 2017.
- [C48] Ebrahimian, H., **Astroza, R.**, Conte, J.P., and Papadimitriou, C. (2017). “A nonlinear model inversion method for joint system parameter, noise, and input identification of civil structures.” *Proc. 10th International Conference on Structural Dynamics (EURODYN 2017)*, Rome, Italy, September 10-13, 2017.
- [C49] Li, Y., **Astroza, R.**, Conte, J.P., and Soto, P. (2017). “Nonlinear FE model updating of seismic isolated bridge instrumented during the 2010 Mw 8.8 Maule-Chile Earthquake.” *Proc. 10th International Conference on Structural Dynamics (EURODYN 2017)*, Rome, Italy, September 10-13, 2017.

Technical reports

- [R1] **Astroza, R.**, Pantoli, E., Selva, F., Restrepo, J.I., Hutchinson, T.C., and Conte, J.P. (2013). “Experimental evaluation of the seismic response of a roof-top mounted cooling tower.” *Structural Systems Research Project Report Series, SSRP 13/14*. University of California San Diego, La Jolla, CA.
- [R2] Pantoli, E., Chen, M.C., Wang, X., **Astroza, R.**, Ebrahimian, H., Mintz, S., Hutchinson, T.C., Conte, J.P., Restrepo, J.I., Meacham, B., Kim, J., and Park, H. (2013). “BNCS Report #2: Full-scale structural and nonstructural building system performance during earthquakes and post-earthquake fire - Test results.” *Structural Systems Research Project Report Series, SSRP 13/10*. University of California San Diego, La Jolla, CA.
- [R3] Chen, M.C., Pantoli, E., Wang, X., **Astroza, R.**, Ebrahimian, H., Mintz, S., Hutchinson, T.C., Conte, J.P., Restrepo, J.I., Meacham, B., Kim, J., and Park, H. (2013). “BNCS Report #1: Full-scale structural and nonstructural building system performance during earthquakes and post-earthquake fire - Specimen design, construction and test protocol.” *Structural Systems Research Project Report Series, SSRP 13/09*. University of California San Diego, La Jolla, CA.
- [R4] Ebrahimian, H., **Astroza, R.**, Conte, J.P. (2014) “Parametric identification of hysteretic material constitutive laws in nonlinear finite element models using extended Kalman filter.” *Structural Systems Research Project Report Series, SSRP 14/06*. University of California San Diego, La Jolla, CA.
- [R5] Ebrahimian, H., **Astroza, R.**, Conte, J.P., Restrepo, J.I., Hutchinson, T.C. (2014) “Nonlinear finite element response simulation of the BNCS building.” *Structural Systems Research Project Report Series, SSRP 14/11*. University of California San Diego, La Jolla, CA.
- [R6] **Astroza, R.**, Ebrahimian, H., Conte, J.P., Restrepo, J.I., and Hutchinson, T.C. (2015). “Influence of the construction process and nonstructural components on the modal properties of a five-story building.”

Structural Systems Research Project Report Series, SSRP 15/08. University of California San Diego, La Jolla, CA.

- [R7] Li, Y., **Astroza, R.**, Conte, J.P., Soto, P. (2016). “Model Parameter Estimation of a Seismic Isolated Bridge using Isolator Component Test Data and Bridge Response Recorded during the 2010 Maule, Chile Earthquake.” *Structural Systems Research Project Report Series, SSRP 16/14.* University of California San Diego, La Jolla, CA.

Earthquake reconnaissance

- [E1] Astroza M., Moroni M.O., **Astroza, R.**, and Norambuena A. (2005). “Intensities and damage distribution in the June 2005 Tarapacá, Chile, earthquake.” EERI Special Earthquake Report. November 2005. (http://www.eeri.org/lfe/pdf/chile_tarapaca_intens_dam_distribution.pdf)
- [E2] Astroza, M., Omerovic, J., **Astroza, R.**, Music, J., Saragoni, G.R., Alvarez, I., Covarrubias, A., Morales, E., Vladilo, S., and Rabello, O. (2008). “Intensity and damage assessment of the 2007 Tocopilla earthquake, Chile.” http://www.eeri.org/site/images/lfe/pdf/chile_20071114.pdf

Academics

- [A1] **Astroza, R.** (2008). “Reinforced concrete: Solved problems.” Educational Publication N°53, Faculty of Engineering and Applied Sciences, Universidad de Los Andes, Chile.
- [A2] **Astroza, R.** (2008). “Statics: Solved problems.” Educational Publication N°52, Faculty of Engineering and Applied Sciences, Universidad de Los Andes, Chile.

Other

- [O1] Astroza, M. and **Astroza, R.** (2008). “Intensities of the 2007 Tocopilla Earthquake, Chile.” *INNOVA*, Vol.5, pp.53-60. (in Spanish)

Patents

- [P1] “Model-Based System for Rapid Post-Disaster Health Monitoring and Damage Detection of Civil Infrastructures.” U.S. Provisional Patent 62/040,932 filed on August 22, 2014. (with H. Ebrahimian and J.P. Conte)

Research Experience

- 01/2016 – Now: **Assistant Professor.** Faculty of Engineering and Applied Sciences, University of Los Andes, Chile.
 - ✓ Conduct research on earthquake engineering and structural health monitoring.
- 10/2010 – 12/2015: **Graduate Research Assistant.** Department of Structural Engineering, UCSD
 - ✓ Participated in the shake table tests of a full-scale five-story reinforced concrete building (BNCS building) tested on the NEES-UCSD shake table. Duties included: signal processing, study the performance and control system of the shake table, prepare reports with structural responses, damage inspection of structural skeleton and egress systems, and design of white noise input motions.
 - ✓ Conducted research on system and damage identification of civil structures, behavior of nonstructural components under seismic excitation, finite element modeling.
- 01/2006 – 12/2009: **Research Professor.** Faculty of Engineering and Applied Sciences, Universidad de Los Andes, Chile.

- ✓ Conducted research on microzonification and site effects, seismic demand on nonstructural components, and seismic response of instrumented structures.
- 07/2006 – 10/2007: **Graduate Research Assistant.** Department of Civil Engineering, Universidad de Chile.
 - ✓ Studied the response of instrumented structures during earthquakes using a wave propagation approach.

Awards and Honors

2000-2004	Outstanding student. Faculty of Physical and Mathematical Sciences, Universidad de Chile.
2007	Top GPA. Department of Civil Engineering, Universidad de Chile.
2007	Best Graduate Award of Civil Engineering at Universidad de Chile. Chilean Association of Engineers (Colegio de Ingenieros de Chile).
2010-2014	Fulbright-Conicyt Equal Opportunities scholarship.
2009	Becas-Chile scholarship (declined).
2011	Graduate Assistantship. University of California, San Diego.
2011	PEER award – Free registration for the EERI Seminar “seismic design and performance of nonstructural elements.”
2012	NSF fellowship – Asia-Pacific Summer School in Smart Structures Technology at the Indian Institute of Science (Bangalore, India).
2014	EERI Travel Award 10 th U.S. National Conference on Earthquake Engineering (Anchorage, AK).
2014	Nominated for the Kaplan Dissertation Year Fellowship by the Department of Structural Engineering, UCSD.
2015	Graduate Student Association (GSA) – UCSD Travel Grant: IMAC XXXIII (Orlando, FL).
2015	Dissertation Fellowship Award, University of California, San Diego.
2016	Member of the Scientific Committee of EVACES (<i>Experimental Vibration Analysis for Civil Engineering Structures</i>)
2016	Outstanding Research Achievement Recognition, Faculty of Engineering and Applied Sciences, Universidad de los Andes.

Research Projects

- Universidad de Los Andes Research Grant ICIV-001-07. “Evaluation of topographic effects on seismic response”. Assistant Researcher. 2007-2008. Goal: Evaluation of seismic ground motion amplification induced by topographic irregularities. (\$12,000 USD)
- Universidad de Los Andes Research Grant ICIV-002-08. “Seismic response of structures: A dynamic wave propagation approach”. Principal Investigator. 2008-2009. Goal: Analyze the seismic response of structures and non-structural components using a novel dynamic wave propagation approach. (\$10,000 USD)
- Universidad de Los Andes Research Grant ODON-001-09. “Comparing the compressive strength of four structures of reinforced acrylic suprastructures supported by four implants. In Vitro study”. Co-Principal Investigator. 2009-2010. Goal: Measure the compressive strength of three low-cost suprastructures reinforced prosthetic for immediate loading of four implants and comparison with the conventional acrylic protocol. (\$12,000 USD)
- NSF Award #0936505 “Full-scale structural and nonstructural building system performance during earthquakes & post-earthquake fire”. Graduate Student Researcher. 2009-2012. Personal role: System and damage identification of the structural system. (\$5,000,000 USD)

- Universidad de Los Andes Research Grant. “Blind identification of advanced nonlinear structural finite element models using earthquake data”. Principal Investigator. 2016-2018. (\$8,000 USD)
- FONDECYT-Iniciación Research Grant No. 11160009. “Nonlinear finite element model updating for earthquake damage diagnosis of structural systems”. Principal Investigator. 2016-2018. (\$160,000 USD)
- Universidad de Los Andes Grant to fund an international visiting professor. Invited professor: Albert Ortiz-Lasprilla, Universidad del Norte, Colombia. Principal Investigator. 2017. (\$3,000 USD)
- FONDEF-IDeA Research Grant No. ID17I10140. “Monitoring system for structural damage diagnosis and prognosis of wind turbines”. Principal Investigator (Project Director). 2017-2018. (\$455,000 USD)

Courses

- Energy balance based seismic design of buildings. Instructor: Hiroshi Akiyama. Santiago, Chile (September 2005).
- Direct displacement-based seismic design of buildings. Instructors: Nigel Priestley and Gian Michele Calvi. Santiago, Chile (September 2009).
- Nonlinear system identification in structural dynamics. Instructors: Gaëtan Kerschen and Keith Worden. Garden Grove, CA (February 2013).
- Performance based design - State of the practice for tall buildings. Instructors: Ron Hamburger, Farzad Naeim, Jonathan Stewart, Greg Deierlein, John Hooper, Leonard Joseph. Los Angeles, CA (November 2014).

Invited Presentations and Seminars

- *The Mw 7.7 Tocopilla Earthquake of 14 November 2007*, Universidad de Los Andes, Chile (April 2008).
- *Wave propagation and seismic response of structures*, Universidad de Concepción, Concepción, Chile (November 2008).
- *System identification of a 5-story full-scale reinforced concrete building tested on the UCSD shake table: Preliminary results*. University of California, San Diego (October 2011).
- *BNCS project: Input motions and shake table performance*. University of California, San Diego (June 2012).
- *Earthquakes and full-scale shaking table tests*. Englekirk Structural Engineering Center, University of California, San Diego (June 2012).
- *Structural health monitoring for disaster resilient communities*, Pontificia Universidad Católica de Chile, Santiago, Chile (August 2014).
- *Large-scale shake table testing: Structural behavior and monitoring*, II International Symposium in Civil Engineering and Architecture, Universidad Autónoma de Baja California, Tijuana, Mexico (April 2015).
- *Instrumentation and Data Acquisition (rapid visualization and analysis of data): calibration, data reduction/analysis, error analysis, special sensors, GPS*. UC San Diego NHERI workshop: A user’s perspective on shake table seismic testing, University of California, San Diego (December 2015).
- *Calibration of structural and geotechnical models using Bayesian methods*, Pontificia Universidad Católica de Chile, Santiago, Chile (October 2016).
- *Lessons from the September 19, 2017 Mexican Earthquake*, Universidad de Chile, Santiago, Chile (October 2017).
- *The Puebla-Morelos Earthquake of September 19, 2017*, Universidad de los Andes, Santiago, Chile (November 2017).

Membership and Leadership

- Member of Scientific Committee Conference on Experimental Vibration Analysis for Civil Engineering Structures (EVACES). 2016 –
- Earthquake Engineering Research Institute (EERI) 2011 –
- Society of Engineering Mechanics (SEM) 2013 –
- Engineering Mechanics Institute (EMI) 2015 –
- Technical Committee on Structural Health Monitoring and Control - Engineering Mechanics Institute (EMI), American Society of Civil Engineers (ASCE) 2017 –

Professional Service

- Co-organizer (with Professors Joel P. Conte and Costas Papadimitriou) Special Session 103SS – Structural Health Monitoring in Earthquake Engineering, 16th World Conference on Earthquake Engineering (16WCEE), Santiago, Chile (2015-2017).
- Member of Organizing Committee, 7th International Conference on Experimental Vibration Analysis for Civil Engineering Structures (EVACES), San Diego, California (July 2017).
- Peer reviewer for scientific journals:
 1. *Advances in Mechanical Engineering* (Sage).
 2. *Advances in Structural Engineering* (Sage).
 3. *Composites B: Engineering* (Elsevier).
 4. *Computers and Structures* (Elsevier).
 5. *Earthquake Engineering and Engineering Vibration* (Springer).
 6. *Earthquake Engineering and Structural Dynamics* (Wiley).
 7. *International Journal of Distributed Sensor Networks* (Sage).
 8. *Journal of Aerospace Engineering* (ASCE).
 9. *Journal of Engineering Mechanics* (ASCE).
 10. *Journal of Mechanical Engineering Science - Part C* (Sage).
 11. *Journal of Sound and Vibration* (Elsevier).
 12. *Journal of Structural Engineering* (ASCE).
 13. *Journal of Testing and Evaluation* (ASTM).
 14. *Journal of Vibration and Control* (Sage).
 15. *Mechanical Systems and Signal Processing* (Elsevier).
 16. *Structural Control and Health Monitoring* (Wiley).
 17. *Structural Health Monitoring* (Sage).
- Reviewer of research projects and proposals:
 - ✓ University of Santiago - Chile, Office of Research, Development, and Innovation.
 - ✓ National Commission for Scientific and Technological Research (CONICYT) – Fondecyt.
 - ✓ Natural Sciences and Engineering Research Council of Canada (NSERC).
 - ✓ National Commission for Scientific and Technological Research (CONICYT) – International Networks.

Students Advised

Undergraduate thesis conducting to Civil Engineering degree:

1. Ortúzar, Pablo (2008). Dynamic behavior of an instrumented building and validation of seismic analysis methods. Universidad de los Andes, Santiago, Chile.

2. Valín, Sebastián (2008). Acceleration demands on nonstructural components. Universidad de los Andes, Santiago, Chile.
3. Kovacevic, Nicolás (2009). Low-frequency seismic waves and their effects on building response. Universidad de los Andes, Santiago, Chile.
4. Martinson, Lars (2009). Topographic effects on the seismic response of the Tarzana hill. Universidad de los Andes, Santiago, Chile.
5. Carbone, Cristián (2009). Evaluation of site amplification via downhole strong motion arrays. Universidad de los Andes, Santiago, Chile.
6. Soto, Andrés (2010). Peak floor accelerations for design of rigid nonstructural components. Universidad de los Andes, Santiago, Chile.
7. Gutiérrez, Gonzalo (2016). Linear time variant and linear time invariant modal properties of a full-scale five-story building tested on a shake table. Universidad de los Andes, Santiago, Chile.
8. Ureta, Santiago (2016). Intensity attenuation in Chile considering earthquakes from 1906 to 2016. Universidad de los Andes, Santiago, Chile.
9. Repenning, Christian (2017). Seismic response behavior of a full-scale five-story building tested on a shake table. Universidad de Los Andes, Santiago, Chile.
10. Carrillo, Gonzalo (2017). Dynamic characterization of a wind turbine tested on a shake table. Universidad de los Andes, Santiago, Chile.
11. Versluys, Andrés (2017). Design and construction of a reduced-scale structural specimen for static and dynamic tests, Universidad de los Andes, Santiago, Chile.
12. Alessandri, Andrés (2017). Dealing with modeling errors in nonlinear mechanics-based finite element model updating, Universidad de los Andes, Santiago, Chile.
13. Torrealba, Juan Pablo (2017). Effect of scour on the seismic response of a reinforced concrete Chilean bridge, Universidad de los Andes, Santiago, Chile.
14. Moncada, Anibal (In Progress). Universidad de los Andes, Santiago, Chile.
15. Barrientos, Nicolás (In Progress). Universidad de los Andes, Santiago, Chile.
16. Hurtado, José Ignacio (In Progress). Universidad de los Andes, Santiago, Chile.
17. Hillmann, Francisco (In Progress). Universidad de los Andes, Santiago, Chile.
18. Diaz, Nicole (In Progress). Universidad de los Andes, Santiago, Chile.
19. Santander, Eduardo (In Progress). Universidad de los Andes, Santiago, Chile.
20. Birrell, Matias (In Progress). Universidad de los Andes, Santiago, Chile.

Professional Experience

- **Structural Engineer.** SyS Ingenieros Consultores (03/2005 – 05/2006, 03/2007 – 12/2009, 06/2016 – Now). Main duties: structural analysis and design of residential and office buildings, civil works, industrial equipment, mechanical equipment and revision and design of industrial projects (mainly mining and energy projects).
- **Private Consultant.** 2006-2009. Analysis, design, and retrofit of several low and mid-rise reinforced concrete buildings.