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## EROL KALKAN, PH.D., P.E.

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### Profile

I, Dr. Erol Kalkan, am a Research Structural Engineer and Project Manager at the Earthquake Science Center of United States Geological Survey in Menlo Park, California.

I earned my B.Sc. degree in Civil Engineering and M.Sc. degree in Engineering Seismology from the Middle East Technical University. My second M.Sc. degree in Structural Engineering is from the Bosphorus (Bogazici) University in Turkey. My doctorate degree is in Structural Engineering (major) and Geotechnical Engineering (minor) from the University of California, Davis. My postdoctoral studies were conducted at the University of California, Berkeley.

I have nineteen years of experience in conducting multi-component research and consulting as a practitioner. I am the author and co-author of more than 120 peer-reviewed publications on various issues in structural engineering, dynamics, earthquake engineering and engineering seismology. I am an active member of American Society of Civil Engineers (ASCE) – *Seismic Effects Committee*, and *Structural Health Monitoring and Control Committee*.

I was the recipient of the “2008 American Society of Civil Engineers Raymond C. Reese Research Prize in Structural Engineering”. I have been also granted “2008 EERI-FEMA NEHRP Professional Fellowship in Earthquake Hazard Reduction”.

I have served as a guest editor of five special journal issues in *Engineering Structures*, *ASCE Journal of Structural Engineering*, and *Seismological Research Letters*.

I am currently acting as an associate editor for *Earthquake Spectra*, *ASCE Journal of Structural Engineering*, *Engineering Structures*, and *Seismological Research Letters*. I am also a regional editor for *International Journal of Earthquake and Impact Engineering*.

### Education

University of California, Davis, Ph.D., Structural Engineering (major) Geotechnical Engineering (minor), 2003-2006,

Middle East Technical University – M.Sc., Engineering Seismology, 2000-2001

Bosporus University – M.Sc., Structural Engineering, 1999-2001

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Middle East Technical University — B.Sc., Civil Engineering, 1993-1998

### Research Areas

Digital signal processing, performance-based seismic design, nonlinear finite element modeling of structures, dynamics, machine vibration, structural health monitoring and damage detection, soil-structure interaction, wave propagation, ground-motion selection and scaling, probabilistic and deterministic seismic hazard assessment, fault-displacement hazard, and ground-motion prediction.

### Professional Experience

#### **Research Structural Engineer, Project Manager, United States Geological Survey; Menlo Park, CA — 2008-Present**

Managed the USGS's national strong motion network between 2008-2013.

Managing multi-disciplinary research projects (details are given under "Present and Past Multi-disciplinary Research Projects").

#### **Senior Engineer/Seismologist, California Geological Survey; Sacramento, CA — 2007-2008**

Conducted seismic hazard analyses, and reviewed ground-motion selection and scaling sections of geotechnical reports prepared for OSHPD and DSA for new hospital and school projects.

#### **Adjunct Professor, Department of Civil Engineering, California State University, Sacramento, CA — 2006-2007**

Taught "Theory of Structures" to senior and junior civil engineering students.

#### **Associate Seismologist, California Geological Survey; Sacramento, CA — 2005-2007**

Processed strong ground-motions, and conducted site surveys and prepared instrumentation design for a number of hospitals and privately-owned buildings in California.

#### **Private Consultant — 2001-2006**

Conducted seismic hazard assessment, machine-vibration analyses, fault-displacement hazard computations, and ground-motion characterizations for hydroelectric power plants, nuclear power plants, hospitals, tunnels, dams and terrestrial and submarine fiber-optic networks.

#### **Research & Teaching Assistant, Department of Civil and Environmental Engineering, University of California, Davis, CA — 2003-2005**

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Conducted finite element modeling of buildings, developed a new nonlinear static analysis method, worked on characteristics of near-field ground motions and their implications on structures, and developed a new intensity measure.

**Research Assistant, Department of Civil and Environmental Engineering,  
Rensselaer Polytechnic Institute, Troy, NY — 2002-2003**

Conducted finite element (FE) modeling of soil-structure systems, worked on constitutive modeling of sand, and compared centrifuge experiment results with those of FE analyses.

**Present and Past Multi-disciplinary Research Projects**

**1. PI: Instrumenting U.S. Veterans Affairs Hospitals in Seismic Regions, and Developing Real-time Structural Health Monitoring and Damage Detection System**

I am the project leader responsible for densely instrumenting 28 Veterans Affairs (VA) hospitals in high and very high seismic regions for earthquake monitoring. I am also responsible for developing a real-time structural-health monitoring (SHM) and damage detection system. This multi-phase multi-million dollars project will be complete in 2018. As a project leader, I establish the work plan and manage the project. I ensure that the project deliverables are completed on time. I led a group of researchers to develop sophisticated SHM software. I also worked closely with USGS Golden office for customization of ShakeCast for VA.

My other responsibilities have been conducting research on SHM, performing site-surveys, designing sensor layouts, communication with hospital managements, preparing purchase orders, working with subcontractors, renewing contracts, writing new inter-agency agreements as needed, and disseminating the results to the public, and internal and external stakeholders. This is the nation's largest seismic instrumentation project by number of sensors deployed and structures instrumented. The project will provide comprehensive SHM information on structural integrity of hospitals to VA for public safety (<http://earthquake.usgs.gov/monitoring/buildings/va.php>). Funding: VA (\$8.5 million).

**2. Co-PI: Development of Automated Processing and Review Interface for Strong Motion Data (PRISM) Software**

As a co-PI, I work with Christopher Stephens, Jeanne Jones and Peter Ng at USGS to develop an automated ground motion processing (PRISM) software. PRISM is designed to be modern, state-of-the-art software which will drop the processing times from days to minutes. I established and tested all essential signal-processing modules. PRISM has a number of unique features, including a *P*-phase arrival time detection algorithm to detect event-time for pre-event

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offset correction and removal of background noise, and a robust adaptive-baseline correction algorithm. The later algorithm corrects acceleration records contaminated by DC offset and/or tilt that cannot be corrected simply with a polynomial fit. I developed both algorithms. I also led an effort to design benchmarks tests for validation of PRISM against BAP and California Geological Survey's Strong Motion Instrumentation Program processing. The source code is available at <https://github.com/usgs/prism> to be used by regional networks as well as engineers and scientists. Funding: USGS internal funds.

**3. Co-PI: Ground-motion Prediction Modeling for Shallow Crustal Continental Regions Considering Regional Variations**

Ground-motion prediction equations (GMPEs) are essential components of probabilistic and deterministic seismic hazard studies for engineering applications. The objective of this project is to improve the GMPEs that I developed in 2007 and 2009 in collaboration with Vladimir Graizer from the U.S. Nuclear Regulatory Commission. This project also involves testing of our GMPEs for ground-motion estimates from induced earthquakes, frequently occurring in Oklahoma, Kansas and Texas. Funding: USGS internal funds.

**4. PI: Ground-motion Characterization and Structural Response**

I conduct a broad range of research studies that include nonlinear finite-element modeling of instrumented buildings, wave propagation in soil-structure systems, development of fragility functions, development and testing of ground-motion selection and scaling methods for nonlinear analyses of buildings and bridges, and improving building code methods for seismic analysis/design of structures. Funding: USGS internal funds.

**5. Co-PI: ShakeCAST**

I am currently working with David Wald and his team at USGS Golden, CO for planning and coordinating next generation of ShakeCAST using HAZUS 's advanced engineering building module for rapid performance and loss assessment of buildings.

**6. Co-PI: Experimental Evaluation of Ground-motion Scaling Methods for Nonlinear Analysis of Structural Systems**

This National Science Foundation joint project with the University of Notre Dame was successfully completed, and final project report was submitted to NSF. The project's broad objective was to experimentally verify ground-motion selection and scaling methods considering a wide range of structural properties, seismic hazard conditions, and hazard levels in order to improve design practice for nonlinear analysis of building structures. During the course of this project, my responsibility was to provide technical assistance on ground motion scaling

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methods and nonlinear finite-element modeling of test specimens, select and prepare appropriate ground motion sets for shake table experiments, and interpret the experimental and numerical results. I also co-advised a M.Sc. student. Funding: National Science Foundation (\$165k).

#### **8. Manager - National Strong Motion Network**

Between 2008 and 2013, I served as a manager of national strong motion project (NSMP) network (<http://earthquake.usgs.gov/monitoring/nsmp/>), and supervised seven electronics technicians. My primary duty was to plan and organize workflow for instrumentation of structures and free-field sites, as well as maintenance and upgrades of the existing stations. I was also responsible for designing instrumentation plans for new structural installation projects, preparation of purchase orders and contracts with external agencies and private companies. As an active communicator, I also promoted and represented the NSMP in national and international venues and meetings. In addition, I managed reimbursable contracts with number of agencies including Oregon Department of Transportation, Los Angeles Metropolitan Water District, U.S. Veterans Affairs, University of Puerto Rico, Seattle City Light, City of Anaheim, and Army Corp of Engineers. Funding: USGS/ANSS (\$5 million).

#### **Skills**

MatLAB, DIANA, OPENSEES, SAP, ETABS, AutoCAD, ArcGIS

#### **Scientific Leadership**

Since joining the USGS in Nov. 2008, I have played an active and ever growing role in promoting the NSMP and use of its products in engineering and scientific communities within and outside of the USGS, and also conducting core research on structural engineering and engineering seismology.

As NSMP's network manager, I interacted with a broad range of outside institutions and took a leadership/management role in directions of USGS programs as a task leader. I initiated cooperative technical agreements with the Los Angeles Department of Water and Power, University of Puerto Rico, Seattle City Lights, University of Nevada, Las Vegas, City of Anaheim, NASA Jet Propulsion Laboratory, Oregon Department of Transportation, and VA. These agreements brought external funding for instrumentation of new structures (including buildings, bridges, dams and tunnels) and free-field stations, and maintenance of existing stations.

I completed successfully instrumentation of 28 VA hospitals across the country (from Alaska to Puerto Rico) in collaboration with the VA in 2013. I also completed successfully four additional instrumentation projects to better understand the behavior of various structures under seismic actions. These instrumentation projects

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include an irrigation and flood-control dam in Anaheim in collaboration with the City of Anaheim (completed in 2010), the Science and Engineering Building of University of Nevada, Las Vegas (UNLV) in collaboration with the Department of Civil Engineering of the UNLV (completed in 2012), the tallest residential building in California (62-story tower in San Francisco) in collaboration with the California Geological Survey's Strong Motion Instrumentation Program (completed in 2013), and Terminal Hill tunnel and shaft in Sylmar in collaboration with the Los Angeles Department of Water and Power (completed in 2016).

I organized numerous meetings in Menlo Park with instrument manufacturers including Kinemetrics in 2009, Reftek in 2009 and Geosig in 2009, Hewlett Packard in 2010, Guralp in 2011, Straen in 2013 for demonstration of their new products and developments to NSMP and Northern California Seismic Network staff. These meetings helped us to select proper hardware for instrumentation of VA hospitals.

In Dec. 2010, I organized a meeting in Menlo Park with Japanese strong motion network (KikNET and KNET) to share knowledge, experience and new projects of two institutes on strong motion network and operations. This meeting helped us to improve foundation detailing of NSMP's free-field stations following the Japanese practice.

#### **Technical Training Received**

Business Process Re-engineering (1999, Istanbul, Turkey)

Supervisory Management (2009, USGS, Menlo Park)

Coulomb Stress Modeling (2010, SCEC, Palm Springs)

#### **Licenses, Honors, Awards and Recognition**

**Licensed Professional Engineer in California, 2008 – present**

**Outstanding Research Award, 2004**, University of California, Davis

**American Society of Civil Engineers Raymond C. Reese Research Prize in Structural Engineering, 2008** (This prize is given once a year to a paper published in Journal of structural Engineering to recognize outstanding contributions to the application of structural engineering research)

**EERI-FEMA-NEHRP Professional Fellowship in Earthquake Hazard Reduction, 2008** (This prestigious fellowship is given to an individual once a year. I received this fellowship for my research study to develop practical guidelines to select and scale earthquake records for nonlinear response history analysis of structures. This research was conducted in collaboration with Prof. Anil K. Chopra of the

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Department of the Civil and Environmental Engineering, University of California, Berkeley)

**USGS STAR Award, 2010** (In recognition of my pivotal efforts to manage deployment of aftershock instruments in the aftermath of the 2010 El-Mayor Cucapah earthquake)

**USGS STAR Award, 2010** (In recognition of my pivotal efforts with the NSMP's network operations and managing reimbursable contracts)

**USGS STAR Award, 2014** (In recognition of my pivotal efforts with field surveys with damage assessment and deployment of aftershock instruments in the aftermath of the 2014 South Napa earthquake)

### **Editorial Board Positions**

Associate Editor, Seismological Research Letters (2010 – present)

Associate Editor, Journal of Structural Engineering (2010 – present)

Associate Editor, Earthquake Spectra (2012 – present)

Associate Editor, Engineering Structures (2014 – present)

Regional Editor, International Journal of Earthquake and Impact Engineering, (2016 – present)

Guest Editor (Kalkan E.): Seismological Research Letters

“The 24 August 2014 Magnitude 6.0 South Napa Earthquake”, March/April, 2015.

Guest Editor (Kalkan E. and Luco N.): Journal of Structural Engineering

“Computational Simulation in Structural Engineering”, Vol. 140, No. 8, 2014.

Guest Editor (Kalkan E.): Seismological Research Letters

“The 22 February 2011 Magnitude 6.2 Christchurch Earthquake”, Vol. 82, No. 6, 2011.

Guest Editor (Kalkan E.): Journal of Structural Engineering

“Earthquake Ground Motion Selection and Modification Methodologies for Nonlinear Dynamic Analyses of Structures”, Vol. 137, No. 3, 2011.

Guest Editor (Laefer D. and Kalkan E): Engineering Structures

“Seismic Reliability, Analysis, and Protection of Historic Buildings and Heritage Sites”, 2008.

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### Chair (Technical Subcommittee)

Earthquake Engineering Research Institute: *Heritage and Existing Structures Committee* (2008 – 2009; 2012 – 2013)

Session chair: American Geophysical Union Fall Meeting, San Francisco (2016)

Session chair: 16th World Conference on Earthquake Engineering, Santiago, Chile (2016)

### Member (Technical Subcommittee)

University of California Berkeley, Pacific Earthquake Engineering Research Center: Ground-motion Selection and Modification Research Committee (2006 – 2012)

California Geological Survey Research Proposal Review Panel (2006)

Earthquake Engineering Research Institute: Heritage and Existing Structures Committee (2004 – 2013)

American Society of Civil Engineers, Structural Engineering Institute: Seismic Effects Committee (2008 – present)

National Eq. Hazard Reduction Program Proposal Evaluation Panel (2009 )

American Society of Civil Engineers, Engineering Mechanics Institute: Structural Health Monitoring and Control Committee (2012 – present)

U.S. – Japan Panel on Wind and Seismic Effects (2009 – 2013)

USGS National Strong Motion Project Working Group (2012 – 2016)

Structural Engineering Association of Central California (2013 – present)

American Society of Civil Engineers, Structural Engineering Institute, Sacramento Chapter (2014 – present)

USGS HayWIRED Project Review Panel (2016 – present)

Earthquake Effects USGS External Grants Review Panel (2016)

### Invited Seminars

2007 University of California, Department of Civil Engineering, Los Angeles, California. *Rotational Seismology*.

2008 U.S. Geological Survey, Earthquake Science Center, Menlo Park, California. Adaptive Nonlinear Analysis as Applied to Performance-Based Earthquake Engineering.



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- 2008 Tufts University, Department of Civil Engineering, Boston, Massachusetts, *Adaptive Nonlinear Analysis as a New Tool for Practicing Engineers*.
- 2008 Department of Mathematics, California State University, Sacramento, California. *Nonlinear Static Analysis in Structural Engineering*.
- 2010 University of Southern California, Los Angeles, California. U.S. National Strong Motion Project – Structural Instrumentation.
- 2010 University of California, Department of Civil Engineering, Irvine, California. *Future of the U.S. National Strong Motion Project*.
- 2010 ARUP, San Francisco, California, U.S. Geological Survey National Strong Motion Program.
- 2010 University of Notre Dame, Department of Civil Engineering and Geological Sciences, Notre Dame, Indiana, *Assessment and Refinements on Conditional Mean Spectrum*.
- 2011 University of Alaska, Anchorage, Alaska. U.S. National Strong Motion Project: Current Efforts and Future Directions for Alaska.
- 2013 Universidad de Los Andes, Bogota, Colombia, Design and Implementation of an Open Source Structural-health Monitoring and Damage Detection System.
- 2014 U.S. Geological Survey, Earthquake Science Center, Menlo Park, California. *South Napa Earthquake*.

### **Courses Taught**

- 2005 University of California, Department of Civil and Environmental Engineering, Davis, California. *Matrix Structural Analysis*.
- 2008 California State University, Department of Civil Engineering, Sacramento, California. *Theory of Structures*.

### **Graduate Students Advised**

Neal S. Kwong, Ph.D student.

Topic: Ground-motion Selection for Nonlinear Response History Analysis of Structures, University of California, Berkeley, (Ph.D. student: 2010-2011).

Andrew P. O'Donnell, M.Sc. student.

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Topic: Experimental Evaluation of Ground-motion scaling Methods for Nonlinear Analysis of Structural Systems, University of Notre Dame. (MSc. student: 2009-2011).

### Visiting Scientists and Ph.D. Students Hosted

Ken Hatayama, Ph.D. (National Research Institute of Fire and Disaster, Japan)  
Duration: April 2010 – April 2011 | Funding: Japanese Government  
Research Topic: Long Period Ground Motion Amplification in Los Angeles Basins during the M7.2 El-Major Cucapah Earthquake

Assoc. Prof. Juan Carlos Reyes (Universidad de los Andes, Bogota, Colombia)  
Duration: Dec. 1, 2010 – Dec. 15, 2010; June, 1 – July 31, 2011  
Funding: Universidad de los Andes  
Research Topic: Statistical Evaluation of ASCE/SEI 7 Ground-motion Scaling Method

Margaret Segou, Ph.D. (British Geological Survey)  
Duration: Feb. 2011 – Feb. 2012 | Funding: External funds  
Research Topic: Assessment of Ground-motion Prediction Equations and Seismic Hazard Studies for Marmara (Turkey) Region

Fei Wang, (Ph.D. Student, Earthquake Administration of Beijing Municipality, China)  
Duration: Dec. 1, 2013 – January 15, 2014 | Funding: Chinese Government  
Research Topic: Nonlinear Finite-element Modeling and Calibration of Instrumented Structures

Weiping Wen, (Ph.D. Student, Department of Civil Engineering, Harbin University, China)  
Duration: Oct. 1, 2014 – Oct. 1, 2015 | Funding: Chinese government  
Research Topic: Application of Seismic Interferometry to Soil and Soil-structure Systems

### Technical Training Provided

I provided technical training on the use of U.S. Geological Survey national seismic hazard code to seismologists at the California Geological Survey in 2008.

### Technology and Information Transfer and Dissemination

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**Software Development** – I developed  $P_{\text{HASEPICKER}}$ —a powerful tool for automatically picking  $P$ -phase onsets with high precision without requiring detection interval or threshold settings. The algorithm detects  $P$ -phase arrival time in single-component acceleration or broadband velocity records using the histogram method.  $P_{\text{HASEPICKER}}$  has been integrated into the “Automated Processing and Review Interface for Strong Motion Data (PRISM)” software of the U.S. Geological Survey in order to identify the pre-event time-window for systematic and automated processing of large numbers of accelerograms.  $P_{\text{HASEPICKER}}$  is available at <https://earthquake.usgs.gov/research/software/#PPHASEPICKER>

I developed user-friendly computer code for Graizer-Kalkan (2015) ground motion prediction equation (GMPE), which is designed to predict peak-ground acceleration and 5% damped pseudo-spectral acceleration response ordinates for shallow-crustal continental earthquakes to be used in earthquake-engineering applications including probabilistic and deterministic seismic hazard analyses. Its MatLAB version is available at <https://earthquake.usgs.gov/research/software/#gmpe>

Jeanne Jones, Chris Stephens, Peter Ng, and I developed Processing and Review Interface for Strong Motion data (PRISM) software for automatically processing strong ground motion records. PRISM is platform-independent, coded in Java and open-source. The source code is available at <https://github.com/usgs/prism> to be used by regional networks as well as engineers and scientists.

**USGS Open House and Earth Science Day** – In 2009, I arranged the U.S. Geological Survey open house booth for structural health monitoring, and provided interactive computer simulations for seismic performance of buildings during the 1994 Northridge earthquake.

**San José Tech Museum of Innovation’s Tech Challenge Event** – In 2014, I served as a structural engineering expert for San José Tech Museum of Innovation on “The Tech Challenge.” The challenge was an engineering design challenge for 4-12 graders. The challenge involved building a model structure, which will withstand an earthquake. Tests were done on a shake table. I helped the museum for building their test specimens, its instrumentation and construction of the small-scale shake table.

**Discovery Channel's Show** – In 2014, “Myth Busters” had an earthquake episode “Earthquake Survival” premiered on May 15<sup>th</sup>, 2013 where a masonry building and a wood-frame structure were tested on a shake table. For this episode, I provided engineering expertise, and also instrumented their test structures for monitoring during the shaking. Highlights of this episode can be seen at <https://www.youtube.com/watch?v=nO9wc1bkM5>.

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**CHA's Disaster Planning for California Hospitals Conference** – In 2015, I arranged the U.S. Geological Survey booth for seismic instrumentation and structural health monitoring of hospitals.

**Questions from Public via Website** – From 2010 to present my primary outreach to the public was responding to questions submitted via email (usually one or two per month), either sent directly to me or forwarded to me from education and outreach staff.

### Membership in Professional Societies

Earthquake Engineering Research Institute, 2003 – present

Seismological Society of America, 2004 – present

American Geophysical Union, 2006 – present

American Society of Civil Engineers, 2006 – present

Turkish Earthquake Engineering Association, 2010 – present

### References

**Joe Fletcher** (Previous supervisor)

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**Jeanne Jones** (Collaborator)

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**Anil K. Chopra** (Post-doc. advisor)

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### Publications (non-abstracts)

The following is a chronological list of peer-reviewed journal papers, open-file reports, fact sheets and conference proceedings.

124	<b>Kalkan, E.</b> (2017). "An Automatic S-phase Arrival Time Picker", Bulletin of Seismological Society of America. (under preparation)
123	<b>Reyes, J.C., Sierra A. and Kalkan, E.</b> (2017). "Reducing Computational Time of Nonlinear Response History Analysis", Bulletin of Earthquake Engineering. (in-review)
122	<b>Reyes, J.C., Gonzalez, C. and Kalkan, E.</b> (2017). "Improved ASCE/SEI 7-10 Ground-motion Scaling Procedure for Nonlinear Analysis of Buildings", Engineering Structures. (in-review)

121	<b>Jones, J., Kalkan, E., Stephens, C. and Ng, P.</b> (2017). PRISM, Automated Processing and Review Interface for Strong Motion Data Software, Seismological Research Letters. (in-press)
120	<b>Wen, W. and Kalkan, E.</b> (2017). "System Identification Based on Deconvolution and Cross-Correlation—An Application To A Twenty-Story Instrumented Building In Anchorage, Alaska", Bulletin of Seismological Society of America. Vol. 107(2), doi: 10.1785/0120160069.
119	<b>Kalkan, E., Ulusoy, H.S., Wen, W., Fletcher, J.P.B, Wang, F. and Nakata, N.</b> (2017). "Site Properties Inferred at Delaney Park Downhole Array in Anchorage Alaska", Bulletin of Seismological Society of America, (in-press)
118	<b>Kalkan, E. and Wen, W.</b> (2017). "Dynamic Characteristics of a Twenty-Story Instrumented Building in Anchorage, Alaska Identified by Seismic Interferometry", Proc. of the 16th World Conference on Earthquake Engineering, Santiago, Chile, Jan. 9-13, 2017, Paper No. 453.
117	<b>Reyes, J.C., Kalkan, E. and Sierra, A.</b> (2017). "Fast Nonlinear Response History Analyses", Proc. of the 16th World Conference on Earthquake Engineering, Santiago, Chile, Jan. 9-13, 2017, Paper No. 1673.
116	<b>Kalkan, E. and Stephens, C.</b> (2017). Systematic Comparisons between PRISM, BAP and CSMIP Ground-Motion Processing: U.S. Geological Survey Open-File Report 2017–1020, 108 p., <a href="https://doi.org/10.3133/ofr20171020">https://doi.org/10.3133/ofr20171020</a> .
115	<b>Jones, J., Kalkan, E. and Stephens, C.</b> (2017). Processing and Review Interface for Strong Motion Data (PRISM)—Methodology and Automated Processing, Version 1.0.0: U.S. Geological Survey Open-File Report 2017, p. 111. <a href="https://doi.org/10.3133/ofr20171008">https://doi.org/10.3133/ofr20171008</a> .
114	<b>O'Donnell, A.P. Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> (2016). "Experimental Evaluation of Four Ground-motion Scaling Methods for Dynamic Response of Nonlinear Structures", Bulletin of Earthquake Engineering (in-press).
113	<b>Kalkan, E., Fletcher, J.P., Friberg, P. and Baker, L.M.</b> (2016). A Web-enabled Structural Health Monitoring Data Management System for Seismic Instrumentation of Veterans Affairs Hospital Buildings. U.S. Geological Survey, Administrative Report, 60 p.
112	<b>Graizer, V. and Kalkan, E.</b> (2016). "Summary of GK15 Ground-Motion Prediction Equation for Predicting PGA and 5%-Damped SA from Shallow Crustal Continental Earthquakes", Bulletin of Seismological Society of America, 106(2): 687-707, doi: 10.1785/0120150194.
111	<b>Kalkan, E.</b> (2016). "An Automatic P-phase Arrival Time Picker", Bulletin of Seismological Society of America, 106(3): 971-986, doi: 10.1785/0120150111.
110	<b>O'Donnell, A.P., Kurama, Y.C., Taflanidis, A.A. and Kalkan, E.</b> (2015). "A nonlinear frame test structure with repeatable behavior for experimental dynamic response history investigation", Journal of Earthquake Engineering, doi: 10.1080/13632469.2015.1046571
109	<b>Reyes, J.C, Riaño, A.C., Kalkan, E. and Arango, C.M.</b> (2015). "Extending Modal Pushover-Based Scaling (MPS) Procedure for Nonlinear Response History Analysis of Multi-Story Unsymmetric-Plan Buildings", Engineering Structures, 88: 125-137.

108	<b>Kalkan, E.</b> (2015). "Preface to the Focused Issue on the 24 August 2014 Magnitude 6.0 South Napa Earthquake", <i>Seismological Research Letters</i> , March/April.
107	<b>Kalkan, E. and Reyes, J.C.</b> (2015). "Significance of Rotating Ground Motions on Behavior of Symmetric- and Asymmetric-plan Structures: Part 2. Case Studies", <i>Earthquake Spectra</i> , 31(3): 1613-1628.
106	<b>Reyes, J.C. and Kalkan, E.</b> (2015). "Significance of Rotating Ground Motions on Behavior of Symmetric- and Asymmetric-plan Structures: Part 1. Parametric Study", <i>Earthquake Spectra</i> , 31(3): 1591-1612.
105	<b>Graizer, V. and Kalkan, E.</b> (2015). Update of the Graizer-Kalkan Ground-Motion Prediction Equations for Shallow Crustal Continental Earthquakes: U.S. Geological Survey Open-File Report 2015-1009, p. 79 [Download MatLAB codes with Example]
104	<b>Reyes, J.C., Riaño, A.C., Arango, C.M. and Kalkan, E.</b> (2014). Modal Pushover-based Scaling of Earthquake Records for Nonlinear RHA of Multi-story Unsymmetric-plan Buildings", <i>Proc. of the 10th National Conference in Earthquake Engineering</i> , Earthquake Engineering Research Institute, Anchorage.
103	<b>Reyes, J.C., Kalkan, E., Riaño, A.C. and Arango, C.M.</b> (2014). A General Procedure for Selecting and Scaling Ground Motion Records for Nonlinear Analysis of Asymmetric- Plan Buildings", <i>Proc. of the 7th European Workshop on the Seismic Behavior of Irregular and Complex Structures</i> , Opole, Poland.
102	<b>Reyes, J.C., Riaño, A.C., Kalkan, E., Quintero, O.A. and Arango, C.M.</b> (2014). "Is Time-Domain Spectrum Matching Procedure Accurate and Efficient for Response History Analysis of Buildings?", <i>Proc. of the 2nd European Conference on Earthquake Engineering and Seismology</i> , Istanbul, Turkey.
101	<b>Reyes, J.C., Riaño, A.C., Arango, C.M. and Kalkan, E.</b> (2014). "Extending modal pushover-based ground motion scaling procedure to unsymmetric-plan multi-story buildings", <i>Proc. of the 10th National Conference in Earthquake Engineering</i> , Earthquake Engineering Research Institute, Anchorage.
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## Presentations

The following is a chronological list of presentations in conferences and other engineering and scientific venues.

74	<b>Jones, J., Kalkan, E., Stephens, C. and Ng, P.</b> "PRISM, Processing and Review Interface for Strong Motion Data Software", NASA-Ames Research Center, Earth Science Fair, Mountain View, California, Feb. 15, 2017. DOI: 10.13140/RG.2.2.18750.89927.
73	<b>Kalkan, E.</b> "Evaluation of Graizer-Kalkan GMPE for Small-To-Moderate, Shallow Depth "Induced" Events", Induced Seismicity Workshop, United States Geological Survey, Menlo Park, California, Feb. 13-14, 2017.
72	<b>Kalkan, E. and Wen, W.</b> "Dynamic Characteristics of a Twenty-Story Instrumented Building in Anchorage, Alaska Identified by Seismic Interferometry", 16th World Conference on Earthquake Engineering, Santiago, Chile, 2017.
71	<b>Reyes, J.C., Kalkan, E. and Sierra, A.</b> "Fast Nonlinear Response History Analyses", 16th World Conference on Earthquake Engineering, Santiago, Chile, 2017.
70	<b>Jones, J., Kalkan, E., Stephens, C. and Ng, P.</b> "PRISM, Processing and Review Interface for Strong Motion Data Software", American Geophysical Union Fall Meeting, San Francisco, California, 2016.
69	<b>Kalkan, E., Ulusoy, H.S. Wang, F. and Fletcher, J.P.B.</b> "Extracting Site Characteristics at Delaney Park Geotechnical Array in Anchorage, Alaska Using Seismic Interferometry", Seismological Society of America Annual Meeting, Poster-No: 14-204, 2014.
68	<b>Kalkan E. and Tremayne, H.</b> "Napa Earthquake Preliminary Damage Findings", U.S. Geological Survey, Earthquake Science Center, Menlo Park, California, 2014.
67	<b>Kalkan, E., Fletcher, J.P.B., Baker, L.M., Friberg, P. Leith, W. and Banga K.</b> "Development of An Open Source Structural-health Monitoring and Damage Detection System for Sustainable and Resilient Structures", 15th U.S.-Japan Workshop on the Improvement of Structural Engineering and Resiliency, Kona, Big Island, 2014.
66	<b>Kunnath, S.K., Ahmadi, A. and Kalkan E.</b> "Energy-Based Intensity Measure for Seismic Demand Modeling", Proc. of the 2nd European Conference on Earthquake Engineering and Seismology, Istanbul, Turkey, 2014.

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65	<b>Kalkan, E., Fletcher, J.P.B., Ulusoy, H.S. and Baker, L.M.</b> "Ambient Vibration and Earthquake-Data Analyses of a 62-Story Building Using System Identification and Seismic Interferometry", American Geophysical Union Fall Meeting, San Francisco, California, 2014.
64	<b>Reyes, J.C., Riaño, A.C., Arango, C.M. and Kalkan, E.</b> "Extending modal pushover-based ground motion scaling procedure to unsymmetric-plan multi-story buildings", Proc. of the 10th National Conference in Earthquake Engineering, Earthquake Engineering Research Institute, Anchorage, 2014.
63	<b>Kalkan, E.</b> "An Automatic P-Wave Onset Time Detector", Southern California Earthquake Center Annual Meeting, Palm Springs, California, 2014.
62	<b>Reyes, J.C., Kalkan, E., Riaño, A.C., and Arango, C.M.</b> "A General Procedure for Selecting and Scaling Ground Motion Records for Nonlinear Analysis of Asymmetric-Plan Buildings", Proc. of the 7th European Workshop on the Seismic Behavior of Irregular and Complex Structures, Opole, Poland, 2014.
61	<b>Reyes, J.C., Riaño, A.C., Kalkan, E., Quintero, O.A., and Arango, C.M.</b> "Is Time-Domain Spectrum Matching Procedure Accurate and Efficient for Response History Analysis of Buildings?", Proc. of the 2nd European Conference on Earthquake Engineering and Seismology, Istanbul, Turkey, 2014.
60	<b>Kalkan E.</b> "Design and Implementation of an Open Source Structural-health Monitoring and Damage Detection System", Universidad de Los Andes, Bogota, Colombia., 2013.
59	<b>Ulusoy, H.S., Kalkan, E. and Banga, K.</b> "Real-time Seismic Monitoring of Veterans Affairs Hospital Buildings", SPIE Smart Structures Conference, San Diego, California, 2013.
58	<b>Graizer, V. and Kalkan, E.</b> "Updated Graizer-Kalkan GMPE", Southwestern U.S. Ground Motion Characterization SSHAC Level 3 Workshop 2, Berkeley, California, 2013.
57	<b>O'Donnell, A.P. Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> "Experimental evaluation of ground motion scaling methods for the nonlinear analysis of structural systems." Earthquake Engineering Research Institute Annual Meeting, Seattle, Washington, 2013.
56	<b>Kalkan, E.</b> "Real-Time Structural-health Monitoring of VA Hospital Buildings", IRIS Seismic Instrumentation Technologies Symposium, Albuquerque, New Mexico, 2013.
55	<b>O'Donnell, A.P., Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> "Evaluation of ground motion scaling methods for the nonlinear analysis of structural systems." ASCE Structures Congress, Pittsburgh, Pennsylvania, 2013.
54	<b>Reyes, J.C. and Kalkan, E.</b> "Relevance of Normal-Fault and Maximum Components of Ground-Motions on Nonlinear Behavior of Symmetric and Asymmetric Buildings in Near Fault Sites", Proc. of the 15th World Conf. on Earthquake Engineering Lisbon, Portugal, 2012.



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53	<b>O'Donnell, A.P. Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> "Calibration and evaluation of a reusable nonlinear frame structure for use in an experimental ground motion scaling study." Joint Conference of the Engineering Mechanics Institute, South Bend, Indiana, 2012.
52	<b>Reyes, J.C. and Kalkan, E.</b> "Significance of Rotating Ground Motions on Nonlinear Behavior of Symmetric and Asymmetric Buildings in Near Fault Sites", Proc. of the 9th International Conf. on Urban Earthquake Engineering / 4th Asia Conf. on Earthquake Engineering, March 6-8, Tokyo Institute of Technology, Tokyo, Japan, 2012.
51	<b>Kalkan, E., Fletcher, J., Leith, W., McCarthy, J., and Banga, K.</b> "Real-time Seismic Monitoring of Instrumented Hospital Buildings", Earthquake Engineering Research Institute Annual Meeting, Memphis, Tennessee, 2012.
50	<b>O'Donnell, A.P. Kurama, Y.C. and Kalkan, E.</b> "Calibration and evaluation of a reusable nonlinear frame structure for use in an experimental ground motion scaling study", NSF CMMI Engineering Research and Innovation Conference, Boston, Massachusetts, 2012.
49	<b>Kalkan, E.</b> "Seismic Instrumentation and Health Monitoring of Medical Centers in U.S.", Earthquake Engineering Research Institute Annual Meeting, Memphis, Tennessee, 2012.
48	<b>O'Donnell, A.P. Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> "Calibration of a reusable nonlinear beam-column connection for use in an experimental ground motion scaling study." American Society of Civil Engineering, Structures Congress, Chicago, Illinois, 2012.
47	<b>Kalkan E.</b> "U.S. National Strong Motion Project: Current Efforts and Future Directions for Alaska, University of Alaska", Anchorage, Alaska, 2011.
46	<b>Segou, M., Parsons, T. and Kalkan, E.</b> "Coulomb Static Stress Interactions between $M > 5$ Earthquakes and Major Active Faults in Northern California", American Geophysical Union Fall Meeting, San Francisco, California, 2011.
45	<b>Hatayama, K. and Kalkan, E.</b> "Long-Period (3 to 10 s) Ground Motions in and around the Los Angeles Basin during the Mw7.2 El-Mayor Cucupah Earthquake of April 4, 2010", 4th IASPEI / IAEE International Symposium, University of California, Santa Barbara, California, 2011.
44	<b>O'Donnell, A.P. Beltsar, O.A., Kurama, Y.C., Kalkan, E. and Taflanidis, A.A.</b> "Evaluation of ground motion scaling methods for the nonlinear analysis of structural systems." ASCE Structures Congress, Las Vegas, Nevada, 2011.
43	<b>Segou, M. and Kalkan, E.</b> "Ground Motion Attenuation during M7.1 Darfield and M6.3 Christchurch (New Zealand) Earthquakes and Performance of Global Predictive Models", Southern California Earthquake Center Annual Meeting, Palm Springs, California, 2011.
42	<b>Kalkan, E.</b> "U.S. National Strong Motion Project – Structural Instrumentation", University of Southern California, Los Angeles, California, 2010.
41	<b>Kalkan, E.</b> "Future of the U.S. National Strong Motion Project", University of California, Department of Civil Engineering, Irvine, California, 2010.

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40	<b>Kalkan, E.</b> "Assessment and Refinements on Conditional Mean Spectrum", University of Notre Dame, Department of Civil Engineering and Geological Sciences, Notre Dame, Indiana, 2010.
39	<b>Kalkan, E.</b> "U.S. Geological Survey National Strong Motion Program", ARUP, San Francisco, California, 2010.
38	<b>Kalkan, E. and Chopra, A.K.</b> "Conditional Mean Spectrum: Assessment and Refinements", Cosmos Annual Meeting, Berkeley, California, 2010.
37	<b>Kalkan, E., Hatayama, K., Segou, M. and Sevilgen, V.</b> "Characteristics of Ground Motion Attenuation during the M7.2 El Mayor Cucapah (Baja) Earthquake", Southern California Earthquake Center Annual Meeting, Palm Springs, California, 2010.
36	<b>Hatayama K. and Kalkan E.</b> "Long-Period (3 to 10 s) Ground Motions Observed in and around the Los Angeles Basin during the Mw7.2 El Mayor-Cucapah Earthquake and Their Implications on Oil Tanks", American Geophysical Union (AGU) Fall Meeting, San Francisco, California, 2010.
35	<b>Hatayama, K. and Kalkan E.</b> "Characteristics of Long-Period (3 to 10 s) Strong Ground Motions Observed in and around the Los Angeles Basin during the Mw7.2 El Mayor-Cucapah Earthquake of April 4, 2010", Southern California Earthquake Center Annual Meeting, Palm Springs, California, 2010.
34	<b>Graizer, V. and Kalkan, E.</b> "Strong motion seismology and rotations: history and future directions", Second International Workshop on Rotational Seismology, Prague, Czech Republic, 2010.
33	<b>Kalkan, E. and Graizer, V.</b> "Tilt Errors on Recorded Accelerations from Instrumented Structures", Second International Workshop on Rotational Seismology, Prague, Czech Republic, 2010.
32	<b>Graizer, V., Kalkan, E. and Lin, K.W.</b> "Extending and Testing Graizer-Kalkan Ground Motion Attenuation Model Using Atlas Database of Shallow Crustal Events", 9th US National and 10th Canadian Conference on Earthquake Engineering, Toronto, Canada, 2010.
31	<b>Kalkan, E.</b> "U.S. National Strong Motion Network: Recent and Ongoing Projects", Second Euro-Mediterranean Meeting on Accelerometric Data Exchange and Archiving, Ankara, Turkey, 2009.
30	<b>Kalkan, E.</b> "Seismic Monitoring of Building, Bridges and Lifelines", ERA/CUBE Partners Meeting, Caltech, October, Pasadena, California, 2009.
29	<b>Kalkan, E. and Chopra, A.K.</b> "Modal Pushover-based Ground Motion Scaling Procedure", Structural Engineering Association of California Annual Convention, San Diego, California, 2009.
28	<b>Kalkan, E. and Chopra, A.K.</b> "Modal Pushover-based Ground Motion Scaling Procedure for Nonlinear Analysis of Structures", UJNR 41st Joint Panel Meeting, Tsukuba, Japan, 2009.
27	<b>Kalkan, E. and Chopra, A.K.</b> "Development of Modal Pushover-based Ground Motion Scaling Procedure", Earthquake Engineering Research Institute Annual Meeting, Salt Lake City, Utah, 2009

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26	<b>Graizer, V., Kalkan, E. and Lin, K.W.</b> "Global Ground-motion Prediction Model for Shallow Crustal Regions", Southern California Earthquake Center Annual Meeting, Palm Springs, California, 2009.
25	<b>Graizer, V., Kalkan, E. and Lin, K.W.</b> "Graizer-Kalkan Ground Motion Attenuation Model based on Atlas Database of Shallow Crustal Events", Seismological Society of America Annual Meeting, Monterey, California, 2009.
24	<b>Kalkan, E., Wills, C.J. and Branum, D.</b> "Seismic Hazard Mapping of California Incorporating State Wide VS30 Map", Seismological Society of America Annual Meeting, Monterey, California, 2009.
23	<b>Kalkan, E.</b> "Rotational Seismology", University of California, Department of Civil Engineering, Los Angeles, California, 2008.
22	<b>Kalkan, E.</b> "Adaptive Nonlinear Analysis as Applied to Performance-Based Earthquake Engineering", U.S. Geological Survey, Earthquake Science Center, Menlo Park, California, 2008.
21	<b>Kalkan, E.</b> "Adaptive Nonlinear Analysis as a New Tool for Practicing Engineers", Tufts University, Department of Civil Engineering, Boston, Massachusetts, 2008.
20	<b>Kalkan, E.</b> "Nonlinear Static Analysis in Structural Engineering", Department of Mathematics, California State University, Sacramento, California.
19	<b>Graizer, V. and Kalkan, E.</b> "Novel Approach to Strong Ground Motion Attenuation Modeling", 14th World Conference on Earthquake Engineering, October 13, Beijing, China, 2008.
18	<b>Kalkan, E. and Graizer, V.</b> "Impacts of Rotational Ground Motions on Structures", American Geophysics Union Annual Meeting, December, San Francisco, California, 2008.
17	<b>Kalkan, E., Wills, C.J. and Branum, D.</b> "Seismic Hazard Mapping of California Incorporating Spatial Variability of Site Conditions", Third East Bay Earthquake Hazards Conference, Hayward, California, 2008.
16	<b>Kalkan, E.</b> "Rotational Components and their Impacts on Structural Systems", First International Workshop on Rotation Seismology and Engineering Applications, U.S. Geological Survey, Menlo Park, 2007.
15	<b>Kalkan, E.</b> "Energy-based Ground Motion Scaling Procedure", University of California Berkeley, Pacific Earthquake Engineering Research Center Annual Meeting, San Francisco, California, 2007.
14	<b>Kalkan, E.</b> "Instrumented Moment Frame Steel Buildings Models", Ground Motion Selection and Scaling Workshop, Pacific Earthquake Engineering Research Center, University of California, Berkeley, California, 2006.
13	<b>Kalkan, E.</b> "Strong-Motion Geotechnical Downhole Arrays in California", Pacific Earthquake Engineering Research Center Workshop on Evaluation of Nonlinear Site Response, Oakland, California, 2006.
12	<b>Kalkan, E.</b> "Energy-based Ground Motion Scaling Procedure for Nonlinear Transient Analysis of Buildings", Cosmos Annual Meeting, Berkeley, California, 2006.

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11	<b>Gulkan, P. and Kalkan, E.</b> "Ground-motion Predictions for Turkish Earthquakes", International workshop on comparative studies of the North Anatolian Fault and the San Andreas Fault (Southern California), Istanbul, Turkey, 2006.
10	<b>Kalkan, E., Haddadi, H. and Shakal, T.</b> "Seismic Input Energy (EI) of Ground Motions During the 2004 (M6.0) Parkfield California Earthquake", Eighth National Earthquake Engineering Conference, San Francisco, California, 2006.
9	<b>Kalkan, E. and Erduran, E.</b> "Duration Effect on Seismic Response of Structures", Eighth National Earthquake Engineering Conference, San Francisco, California, 2006.
8	<b>Kalkan, E. and Kunnath, S.K.</b> "Evaluation of Adaptive Modal Combination Procedure for Vertically Irregular Structures", Eighth National Earthquake Engineering Conference, San Francisco, California, 2006.
7	<b>Kalkan, E. and Kunnath, S.K.</b> "Evaluation of Two Ground Motion Scaling Methods to Estimate Mean Structural Demands", Eighth National Earthquake Engineering Conference, San Francisco, California, 2006.
6	<b>Kunnath, S.K. and Kalkan, E.</b> "Capacity Curves: The IDA Capacity Curves: The Need for Alternative Intensity Need for Alternative Intensity Factors", Structures Congress, New York, 2005.
5	<b>Kunnath, S.K., Jeremic, B., Kalkan, E., Larson, L., Bauer, K. and Felten, A.</b> "Application of the PEER Performance-based Methodology for Seismic Assessment of the I-880 Viaduct", California Department of Transportation Bridge Research Conference, Sacramento, California, 2005.
4	<b>Kalkan, E. and Gulerce, U.</b> "Artificial-Neural-Network based Ground Motion Attenuation Models", Seismological Society of America Annual Meeting, Lake Tahoe, Nevada, 2005.
3	<b>Kalkan, E. and Kunnath, S.K.</b> "Method of Modal Combinations for Pushover Analysis of Buildings", Thirteenth World Conference on Earthquake Engineering, Vancouver, British Columbia, 2004.
2	<b>Kalkan, E.</b> "Enhanced Seismic Resistant of Shear-Wall Dominant Building Structures", State Engineering Week, New York Department of Transportation, Albany, New York, 2003.
1	<b>Kalkan, E. and Balkaya, C.</b> "Three-Dimensional Nonlinear Seismic Performance of Tunnel Form Buildings", 13th Annual Meeting of Earthquake Engineering Research Institute, Portland, Oregon, 2003.