Satish Pullammanappallil, Ph.D.
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Education

The University of Nevada, Reno, Nevada, USA
Degree: Ph. D. Geophysics, November 1994.
Thesis Title: Nonlinear optimization to estimate velocities and image reflectors from multi-offset seismic data. Thesis Advisor: Dr. John N. Louie, Professor of Geophysics, Seismology Lab, University of Nevada, Reno.

Professional Experience

Founder & Geophysicist, SubTerraSeis, Reno, Nevada, USA, November 2017 – present.

Visiting Assistant Research Professor, Seismological Laboratory, University of Nevada, Reno; January 1997-present: Responsibilities include working as a research associate as well as graduate student advisor and dissertation committee member.

Co-Founder, Vice-President & Chief Scientist, Optim, Reno, Nevada, USA; December 1997 – September 2017: Primary responsibilities included coordination of geophysical research, commercial software development and seismic data processing. Additional responsibilities included duties of Secretary, Treasurer, and Financial Officer of Corporation.

S**enior Staff Geophysicist, William Lettis and Associates (WLA)**, Walnut Creek, California; January 1997-July 1998, July 1998 - October 1998 (part time): Responsibilities included processing of seismic reflection and refraction data, performing velocity optimization and pre-stack Kirchhoff migration to map subsurface structures in areas that have undergone complex tectonic processes.

Professional Affiliations

Member of the American Geophysical Union (AGU)
Member of the European Association of Exploration Geoscientists (EAGE)

Funded Projects and Sponsored Research Participation

1. An integrated seismic experiment across a continental rift: the Newark basin - sponsored by the National Science Foundation, 1991.

2. Nonlinear velocity inversion for subsurface imaging of the Hosgri fault, offshore California - sponsored by the U.S. Geological Survey, 1992-1993.

3. Nonlinear velocity inversion for subsurface images of southern California faults - sponsored by the National Science Foundation, 1992-1993.

4. Geophysical constraints on extensional models for the Death Valley region of California and Nevada - sponsored by the National Science Foundation, 1994.
5. Seismic refraction analysis of the Cane Spring fault, southern Nevada - sponsored by Raytheon Services Nevada, Las Vegas, 1994.

6. Estimation of crustal stochastic parameters from seismic reflection data - sponsored by Air Force Office of Sponsored Research, 1995-1997.

7. Velocity analysis and pre-stack Kirchhoff migration along seismic reflection profiles 1, 3 and 4, Ogiri geothermal structure, Kyushu Island, Japan - funded by Kyokuto Boeki Kaisha, Ltd., Tokyo, Japan, 1997.

8. Development and testing of seismic velocity optimization and imaging techniques for identifying permeable and non-permeable fractures within Dixie Valley geothermal field - sponsored by Department of Energy (DOE), 1997-1998.

9. High-resolution velocity images beneath the seismic line WBE-95-1810 in Kentucky - funded by the West Bay Exploration Company, 1998.

10. Demonstration of integrated seismic data acquisition and processing techniques for 2D and 3D imaging of structures controlling permeability within the Coso geothermal field, East Central California, funded by the U.S. Navy Geothermal Program Office, Naval Air Weapons Station, China Lake, CA, 1999-2000.

11. Integrated geophysical study of the Steamboat prospect, Reno, Nevada, funded by DOE and Caithness Operating Company, 2000.

12. Active source P-wave seismic study at the Lake City geothermal prospect, Lake City, California, funded by Lake City Geothermal LLC, 2001.

13. Detailed three-dimensional acoustic velocity analysis of the Coso geothermal field, funded by the Geothermal Program Office, China Lake, CA, 2003

14. Migration of reflection seismic lines using information from the full 3D velocity model of the Coso geothermal area, funded by the Geothermal Program Office, China Lake, CA, 2004.

15. Data Acquisition and Data Processing of Shear-Wave velocity measurements at 30 sites using the REMI method, funded by NEHRP-ERP SC, subcontracted through University of Nevada, Reno, 2005.

16. USArray project: Prepartion and assistance with installation of the Nevada portion of the USAarray. 2005-2006.

17. Site-condition measurements at precariously balanced rocks constraining ruptures on the Elsinore and San Jacinto faults, funded by USGS, subcontracted through University of Nevada, Reno, 2006.

18. Refraction Microtremor (ReMi) surveys for the Device Assembly Facility at the Department of Energy's Nevada Test Site, funded by Lawrence Livermore National Laboratory, 2006.

19. Integrated geophysical study (three dimensional seismic surveys) of the existing Salton Sea geothermal field, funded by Calenergy Operating Corporation and CHAR LLC, 2006.

20. Active source seismic exploration and development at the Pumpernickel Valley geothermal project, Lander County, Nevada, funded by Nevada Geothermal Power, Inc., 2007.

21. Shear wave velocity map for ANSS stations in Southern California, funded by USGS, subcontracted through University of Nevada, Reno, 2007.

22. Active source seismic exploration and development at the Reese River geothermal project, Humboldt County, Nevada, funded by Sierra Geothermal Power Corp, 2007.

23. Active source seismic exploration and development at the Blue Mountain geothermal prospect, Humboldt County, Nevada, funded by Desert Valley Gold, Inc., 2007.

24. Large scale earthquake parcel classification mapping for increasing public safety and enhancing planning and development within Clark County, Nevada, funded by Clark County Nevada Dept. of Development Services, 2007-2010

25. Large scale earthquake parcel site classification mapping for increasing public safety and enhancing planning and development within the City of Henderson, NV, funded by the City of Henderson, Nevada, completed 2010.

26. Active source seismic investigation of geothermal resources at and in the vicinity of the Oregon Institute of Technology (OIT), Klamath Falls, Oregon, funded by Geo-Heat Center, OIT, 2008

27. Active 2.5D source seismic exploration and development at the Big Smokey Valley geothermal prospect, Nevada, funded by Silver State Geothermal LLC, 2009.

28. Active source seismic surface refection and VSP data acquisition and processing at the Rye Patch Geothermal prospect, Nevada, funded by DOE/Presco Energy, 2010

29. Comprehensive evaluation of the geothermal resource potential within the Pyramid Lake Paiute Reservation, Nevada, funded by DOE via subtract through UNR, 2010

30. Finding large aperture fractures in geothermal resource areas using a three-component long-offset surface seismic survey, PSInSAR and kinematic structural analysis: Application of San Emidio geothermal field, Nevada, funded by DOE/US Geothermal, 2010

31. Advanced imaging of gridded long-offset 2-D active source seismic lines at the Hot Pot geothermal prospect, Nevada, funded by DOE/Oski Energy, 2010

32. Active Source Seismic Exploration and Development at the Stillwater Geothermal Project, Churchill County, Nevada, funded by ENEL North America, 2010

33. Active source seismic experiment at the Round Mountain Gold Mine, funded by Round Mountain Gold Corporation, 2011.

34. Reprocessing of 2D seismic reflection data from Crump Geyser geothermal field, Oregon, funded by Ormat, Inc., 2012.

35. Assessment of site conditions and empirical site response at stations recording near-field extreme ground motions during the 2008 Mogul, Nevada earthquake swarm, funded by USGS/NEHRP-IMW, subcontracted through University of Nevada, Reno, 2012.

36. Determination of 3D-vleocity structure across the deepest portion of the Reno area basin, funded by USGS/NEHRP-IMW, 2012.

37. Imaging of the underground cavity collapse zone at U-20ak, Salut ground zero, using seismic reflection, refraction and ReMi techniques, funded by Lawrence Livermore National Lab, 2012.

38. Gravity exploration of the PGE geothermal lease areas on East Fork, Hood River, Oregon, funded by Portland General Electric, 2012.

39. Active source seismic exploration of the Dixie Valley, Nevada, geothermal field: Funded by the US. Navy Geothermal Program Office, 2013

40. Reflection seismic data processing, analysis and interpretation of data for geothermal exploration of the Kingsley Field, Klamath Falls, Oregon: Funded by Oregon Military Department Installations Division, 2014

41. Active source, wide-offset seismic reflection/refraction study of the Raft River geothermal resource, Cassia County, Idaho, Phase I and II, Funded by Agua Caliente & Walker Ranch, LLC, 2012-2015

42. 3D seismic reflection data processing using velocity optimization and prestack depth migration of the Gurmat geothermal field, Turkey: Funded by GURIS, 2014

43. Ambient noise seismic experiment at Soda Lake, Nevada, geothermal prospect: Funded by the US. DOE., subcontract through UNR, 2013-2014.

44. Determination of 3D-velocity structure across the northeastern portion of the Reno area basin, funded by USGS/NEHRP-IMW, 2014.

45. Determination of deep shear-velocity across the Reno-area basin, funded by USGS/NEHRP-IMW, 2016.

46. Source Physics Experiment 5- Large N Deployment, funded by Lawrence Livermore National Lab, 2015-2016

47. A novel approach to map permeability using passive seismic emission tomography constrained by joint inversion of active seismic and EM data: Funded by the US DOE via subcontract from US Geothermal/Ormat, December 2018.

48. Subsurface geophysical feasibility study in West Lemmon Valley, American Flat Road: Funded by the Truckee Meadows Water Authority (TMWA), Reno, Nevada, June 2018.

49. Quantifying EGS reservoir complexity with an integrated geophysical approach-improved resolution ambient seismic noise interferometry: Funded by the US. DOE., subcontract through UNR, January 2019.

50. Technical services for terrestrial seismic survey and evaluation for PacWave project, Oregon: Funded by Oregon State University and subcontract through Siemens & Associates, May 2019.

Peer-Reviewed Publications & Selected Proceedings

1. **S. K. Pullammanappallil** and J. N. Louie, 1993, Inversion of seismic reflection travel times using a nonlinear optimization scheme: Geophysics, 58, p. 1607-1620.

2. **S. K. Pullammanappallil** and J. N. Louie, 1994, A generalized simulated-annealing optimization for inversion of first-arrival times: Bulletin of the Seismological Society of America, 84. p. 1397-1409.

3. **S. K. Pullammanappallil** and J. N. Louie, 1997, A combined first-arrival travel time-reflection coherency optimization approach to velocity estimation: Geophysical Research Letters, 24, 511-514.

4. J. N. Louie, **S. K. Pullammanappallil**, and W. Honjas, 1997, Velocity models for the highly-extended crust of Death Valley, California: Geophysical Research Letters, 24, 735-738.

5. **S. Pullammanappallil**, A. Levander, and S. P. Larkin, 1997, Estimation of crustal stochastic parameters from seismic exploration data: Journal of Geophysical Research, 102, 15,269-15,286.

6. S. P. Larkin, A. Levander, T. J. Henstock, and **S. Pullammanappallil**, 1997, Is the Moho flat? Seismic evidence for a rough crust-mantle interface beneath the northern Basin and Range: Geology, 25, 451-454.

7. S. Chavez-Perez, J. N. Louie, and **S. K. Pullammanappallil**, 1998, Seismic depth imaging of normal faulting in the southern Death Valley basin: Geophysics, 61, 223-230.

8. R. E. Abbott, J. N. Louie, S. J. Caskey, and **S. Pullammanappallil**, 2001, Geophysical confirmation of low-angle normal slip on the historically active Dixie Valley fault, Nevada: Journal of Geophysical Research, 106, 4169-4181.

9. John N. Louie, Weston Thelen, Shane B. Smith, Jim B. Scott, Matthew Clark, and **Satish Pullammanappallil**, 2004, The northern Walker Lane refraction experiment: Pn arrivals and the northern Sierra Nevada root: *Tectonophysics, 388,* no. 1-4, 253-269.

10. W. J. Stephenson, J. N. Louie, **S. Pullammanappallil**, R. A. Williams, and J. K. Odum, 2005, Blind shear-wave velocity comparison of ReMi and MASW results with boreholes to 200 m in Santa Clara Valley: Implications for earthquake ground motion assessment: *Bull. Seismol. Soc. Amer., 95*, no. 6 (Dec.), 2506-2516.

11. Donghong Pei, John N. Louie, and **Satish K. Pullammanappallil**, 2007, Application of simulated annealing inversion on high-frequency fundamental-mode Rayleigh wave dispersion curves: *Geophysics,* **72**, no. 5 (Sept.-Oct.), p. R77-R85.

12. Jeffery R. Unruh, Francis C. Monastero and **Satish K. Pullammanappallil**, The Nascent Coso Metamorphic Core Complex, East-Central California: Brittle Upper Plate Structure Revealed by Reflection Seismic Data - International Geology Review, Vol. 50, 2008, p. 1–25

13. Donghong Pei, John N. Louie, and **Satish K. Pullammanappallil**, 2008, Improvements on computation of phase velocities of Rayleigh waves based on the generalized R/T coefficient method: *Bull. Seismol. Soc. Amer.*, **98**, 280-287.

14. Pancha, J. G. Anderson, J. N. Louie, **S. K. Pullammanappallil**, 2008, Measurement of shallow shear wave velocities at a rock site using the ReMi technique: *Soil Dynamics and Earthquake Engineering, 28,* 522-535.

15. M. A. Gamal and **S. Pullammanappallil**, 2011, Validity of the Refraction Microtremor (ReMi) method for determining shear wave velocities for different soil types in Egypt: *International Journal of Geosciences*, **2**, 530-540.

16. Zhang, X., Chen, P., **Pullammanappallil, S**., 2014, Automating adjoint wave-equation travel-time tomography using scientific workflow: *Earthquake Science, DOI 10.1007/s11589-013-0032-1.*

17. Finchum, B. A., Louie, J. N., Smith, K. D., **Pullammanappallil S., K**., and Pancha, A., 2014, Validation of Las Vegas Basin response to the 1992 Little Skull Mtn. earthquake as predicted by physics-based Nevada ShakeZoning computations*: Bulletin of the Seismol. Soc. of America, DOI:10.1785/0120130059*

18. Eisses, A., Kell, A., Kent, G., Driscoll, N., Baskin, R., Smith K., Karlin, R., Louie, J., and **Pullammanappallil, S**., 2015, New constraints on fault architecture, slip rates, and strain partitioning beneath Pyramid Lake, Nevada: *Geosphere, v. 11, no 3, doi:10.1130/GES00921.1.*

19. Pancha A., Anderson, J. G., Biasi, G., **Pullammanappallil S., K**., and Anooshepor A., 2015, Empirical site response and comparison with measured site conditions at ANSS Sites in the vicinity of Reno, Nevada*: Bulletin of the Seismol. Soc. of America, Vol. 105, No. 2A., pp 889-911, DOI: 10.1785/0120140028*

20. Basler-Reeder, K., Louie, J., **Pullammanappallil**, **S.**, and Graham M. Kent, 2016, Joint optimization of vertical component gravity and P-wave first arrivals by simulated annealing: *Geophysics, 81, ID59-ID71, DOI: 10.1190/geo20150643.1.*

21. Pancha, A., **Pullammanappallil, S**., West, L. T., Louie, J. N., Hellmer, W. K., 2017, Large-Scale earthquake-hazard class mapping by parcel in Las Vegas Valley: *Bulletin of the Seismol. Soc. of America, Vol 107, i. 2, p 741-749, DOI: 10.1785/0120160300*

22. Pancha, A., **Pullammanappallil, S**., Louie, J. N., Cashman, P. H., Trexler, Jr., J. H., 2017, Determination of 3D basin velocity structure using ambient noise in an urban environment: A case study from Reno, Nevada: *Bulletin of the Seismol. Soc. of America, Vol 107, No. 5, DOI: 10.1785/0120170136*

23. Warren, I., E. Gasperikova, and **S. Pullammanappallil**, 2018, Passive Seismic Emission Tomography Applied to Mapping of Geothermal Permeability, Geothermal Resources Council Transactions, 42.

24. Warren, I., E. Gasperikova, **S. Pullammanappallil**, and M. Grealy, 2018, Mapping Geothermal Permeability Using Passive Seismic Emission Tomography Constrained by Cooperative Inversion of Active Seismic and Electromagnetic Data, Proceedings: Workshop on Geothermal Reservoir Engineering, 43