NAME: Sharad M Kelkar

POSITION: Scientist

CONTACT INFORMATION:

EES-16, Computational Earth Sciences Group, Subsurface Flow & Transport Team, Los Alamos National Laboratory, MS T003, Los Alamos, New Mexico, USA 87505.
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EDUCATION:

- 1972, B.Sc., Physics, University of Bombay, India.
- 1974, M.Sc., Physics, University of Bombay, India.
- 1977, Passed the Ph.D. qualifying examination in Physics, University of Texas at Austin
- 1979, M.S., Petroleum Engineering, University of Texas at Austin
- 1987-1990, Additional coursework including Hydrology, Rock Mechanics, Geophysics, and Numerical Methods at the Minerals Engineering Department at the University of California, Berkeley.
- 1999-2001, Coursework in Psychology at UNM.

WORK EXPERIENCE:

- **1977-1979:** Petroleum Engineering, University of Texas at Austin- experimental measurements of rock deformation at elevated pressures and temperatures on core from geothermal aquifers.
- **1979-1981:** Institute of Gas Technology (Chicago, Illinois) - permeability measurements at elevated pressures and temperatures on geothermal cores, reservoir engineering applied to Geopressured aquifers and Coal Seams.
- **1981-1985:** Terra Tek Inc. (now owned by Schlumberger Inc., Salt Lake City, Utah) - laboratory measurements of rock deformation and fluid flow at elevated pressures and temperatures; field work, reservoir engineering and hydraulic fracturing design in support of the petroleum and other energy related industries. Projects worked on included Unconventional Gas Recovery Projects, Geopressured Aquifers, Coal-bed Methane, and Tight Sands.
- **1985-present:**

  Geothermal Energy:
  - Only three LANL projects received new FY13 AOP funding from DOE-EERE-Geothermal Program Office, all three are under Sharad's leadership as the PI. These projects are 1) Stimulation at Desert Peak and Brady's reservoirs: modeling with the coupled THM code FEHM, 2) Geothermal Code comparison project, and 3)Fenton Hill HDR data archiving
  - As the Deputy Geothermal Lead, working with sponsors to improve LANL's future funding outlook in Geothermal Energy. Projects totaling in excess of $1M have started at LANL over the past two years as a result of Sharad's leadership. The work included 1) providing sponsors with information on LANL capabilities, 2) making numerous presentations at meeting and conferences, 3) help LANL PI's in preparing proposals in response to DOE Funding Opportunity Announcement, and 4) preparing the Annual Operating Plan for FY12and FY13.

- PI for the project titled “Stimulation at Desert Peak and Brady’s reservoirs: modeling with the coupled THM code FEHM”. Leading a team of LANL staff and collaborating with external agencies.
- The modeling work for Desert Peak site has been extremely well-received in the geothermal community. DOE-GTO is currently considering providing additional funding to extend the applications of this work to other projects.
- Invited peer reviewer for DOE’s 2013 Geothermal Technologies Program Peer Review.
- As the lead author, prepared and submitted to DOE the final report on the Fenton Hill Hot Dry Rock project. This work required synthesis of 25 years of R&D and interaction with many current and retired LANL scientists. The submission of this report to DOE has helped improve relationships with DOE-EERE-GTP resulting in an invitation to attend a road-mapping workshop.
- Co-PI on a proposal that won DOE funding for the ‘Imaging and modeling’ project. Worked as a scientist on this project to develop novel numerical models for simulating coupled thermo-hydro-mechanical processes relevant to the Brady’s geothermal field in Nevada. Mentoring a post-doc.

Oil & Gas:

- As a key participant, helped develop a CRADA with the ExxonMobil Upstream Research Company titled “Numerical Modeling Capability for Hydrocarbon Extraction from Oil Shale Deposits”.
- Lead role in the task for development of oil-shale conversion capability in the porous media flow and transport code FEHM 3.0 and coupling it with existing thermo-hydro-mechanical modeling capability
- As the deputy point of contact, actively coordinated monthly reports and collaborating with the sponsor through technical discussions and conference participation.

Carbon Sequestration:

- Lead the development of unique and novel capabilities for solving complex problems involving coupled stress-fluid flow-heat transfer processes in porous fractured rock formations using a fully coupled, implicit approach that combines Control Volume and Finite Element methods in a novel way to handle permeability-stress relationships.
- Participating in a modeling study of wellbore stability.

Working Group on Thermo-Hydrological-Mechanical (THM) Modeling:

Led a working group to develop computational models to simulate coupled stress-fluid flow-heat transfer –chemical processes in porous fractured geological formations, in an effort that supported the LANL’s lead role on several projects in the areas of geothermal energy, carbon sequestration, and fossil fuels. The group included several scientists and post-docs from LANL, Chevron, New Mexico Tech, and University of Auckland (New Zealand).

Yucca Mountain Project:

Lead a multi-million dollar effort over 6 years to author the Analysis and Modeling Report on the transport of contaminants through the saturated zone at the Yucca Mountain. The responsibilities included coordinating and supervising the work of many staff members from several organizations including LANL, SNL, USGS, and consultants.

Contaminant transport modeling:

Developed novel and unique particle tracking models that helped give LANL a lead role on various projects including the Yucca Mountain Project, Underground Test Area, and

Environmental Restoration. The models included random walk methods for dispersion and diffusion, development of codes for particle tracking on fully unstructured grids, particle tracking on partially structured grids, and particle trajectories on sub-grids.

Underground Test Area Environmental Remediation:

Development in FEHM of a particle tracking module for partially structured grids containing Octahedral Mesh Refinement, Development of a code to calculate particle trajectories on sub-grids.

Fenton Hill Hot Dry Rock project:

Design and analysis of hydraulic reservoir tests, field work, helped with the early development of the code FEHM including a module to simulate coupled stress-fluid flow-heat transfer in porous fractured rock.

Central American Geothermal Project:

Testing and analysis of data from the Platanares geothermal field in Honduras, Central America.

Oil & Gas:

Developed a project in collaboration with Shell Oil Company to model compaction and subsidence associated with oil reservoirs in 1990. This was a noteworthy development prior to the institution of the formal CRADA concept at LANL.

CAREER HIGHLIGHTS

Leadership

- Leading scientific teams as the PI on Geothermal Energy projects.
- Lead the development of numerical modeling capabilities for coupled thermal-hydrological-mechanical processes (THM) in geomedia with the LANL code Finite Element Heat Mass (FEHM)
- Led a working group to develop models of coupled stress-fluid flow-heat transfer – chemical processes in porous fractured geological formations. The group included professionals from private industry, national laboratory, and academia.
- Provided leadership to help start DOE-Geothermal Technology Projects totaling in excess of $1M over two years.
- Develop a collaborative project with ExxonMobil Upstream Research Company on numerical modeling of hydrocarbon extraction from oil shale deposits.
- Led a multi-million dollar effort over 6 years to analyze and model the transport of contaminants through the saturated zone at the Yucca Mountain, a site that was being considered for a nuclear waste repository.
- As the lead author, prepared the final report on the original Enhanced Geothermal Energy project. This work required synthesis of 25 years of R&D.

Numerical Modeling

- Lead development of novel numerical models combining Finite Element and Control Volume methods with elastic/plastic deformation and nonlinear permeability models for simulating coupled thermo-hydro-mechanical processes in porous fractured rock formations.
- Developed novel and unique particle tracking models on partially structured grids for dispersion and diffusion.

Laboratory measurements of rock properties

Laboratory measurements of rock deformation and fluid flow at elevated pressures and temperatures in support of the petroleum and other energy related industries.

INVITED TALKS and WORKSHOPS

- Shear failure during injection of Co2 into deep ocean sediments: reservoir engineering. Invited presentation at the American Geophysical Union fall meeting, December 9, 2013.
- FEHM/PyFEHM geomechanics modeling workshop, presented at the University of Auckland, Auckland, New Zealand, November 25, 2013.
- Geothermal Energy- History and Recent Advances in Engineered Geothermal Systems (EGS), Presented at New Mexico Institute of Mining and Technology, New Mexico, USA, September 12, 2013.
- FEHM modeling workshop, presented at the ExxonMobil Upstream Research Company, Houston, Texas, July 23, 2012.
- The world's first Enhanced Geothermal Energy project – a review. Presented at the Depart of energy Geothermal Technologies Office, Washington D.C., March 6, 2012.

COLLABORATIONS

Collaborated with professionals from a number of organizations including Sandia National Laboratory, National Energy Technology Laboratory, USGS, ExxonMobil, Chevron, Baker Hughes, Ormat Inc., Massachusetts Institute of Technology, Temple University, New Mexico Institute of Mining and Technology, University of Colorado, University of Auckland (New Zealand), and Indian Institute of Technology (India).

POSTDOCS MENTORED

- Abhijit Chaudhuri (now professor at the Indian Institute of Technology, Chennai, India.)
- Saikiran Rapaka (now research scientist at Siemen's Corporate Research, NJ)
- Kayla Lewis (now Associate Professor at Monmouth University, NJ)
- Satish Karra (now a staff member at LANL)
- David Dempsey

PROFESSIONAL MEMBERSHIPS

- American Geophysical Union
- Geothermal Resources Council
- American Rock Mechanics Association

PROFESSIONAL SERVICES

- EES-16 representative on WSST for 2013-2014
- Organized a workshop on PFLOTRAN
- Led FEHM workshops
- Technical reviewer for Transport in Porous Media, Journal of Contaminant Hydrology, Geofluids, and International Journal for Numerical and Analytical Methods in Geomechanics.
- Started the EES-16 Brown Bag seminar series, and coordinated it for the first year.
- Tutoring/mentoring students in engineering, science, and mathematics
- Give lectures on Energy and Environment at the Santa Fe High School, Santa Fe, NM, 2011.

OTHER ACTIVITIES/INTERESTS

Studied cognitive science and psychology including coursework at UNM;
Licensed to practice therapeutic massage. Play the flute; Painting; Cooking; Hiking; Reading;

PUBLICATIONS

1. **Kelkar, S**., K. Lewis, S. Karra, G. Zyvoloski, S. Rapaka, H. Viswanathan, P. K. Mishra, S. Chu, D. Coblentz, and R. Pawar. "A simulator for modeling coupled thermo-hydro-mechanical processes in subsurface geological media." *International Journal of Rock Mechanics and Mining Sciences* 70 (2014): 569-580.
2. Ding M, **Kelkar S**, and Meijer A 2011. Modeling of Radionuclide Sorption in the Saturated Zone of Yucca Mountain Rocks: Surface Complexation Approach. *Journal of Environmental radioactivity*, pp. 181-187 DOI: 10.1016/j.jenvrad.2014.06.007
3. Dempsey D, **Kelkar S**, Pawar R. 2014. Passive injection: a strategy for mitigating reservoir pressurization, induced seismicity and brine migration in geologic CO2 storage. *International Journal of Greenhouse Gas Control*, DOI: 10.1016/j.ijggc.2014.06.002
4. Dempsey D, **Kelkar S**, Pawar R, Keating E, Coblentz D. 2014. Modeling caprock bending stresses and their potential for induced seismicity during CO2 injection. *International Journal of Greenhouse Gas Control*, 22, 223–236
5. Pandey SN, Chaudhuri A, **Kelkar S**, Sandeep VR, and Rajaram H. 2013. Investigation of permeability alteration of fractured limestone reservoir due to geothermal heat extraction using three-dimensional thermo-hydro-chemical (THC) model. *Geothermics, http://dx.doi.org/10.1016/j.geothermics.2013.11.004*
6. **Kelkar S**, Srinivasan G, Robinson BA, Roback R, Viswanathan H, Rehfeldt K., and Tucci P. 2013. Breakthrough of contaminant plumes in saturated voclcanic rock: implications form the Yucca Mountain site. *Geofluids*, doi: 10.1111/gfl.12035.
7. Lewis KC, Karra S, **Kelkar S**, 2013, A model for tracking fronts of stress-induced permeability enhancement. *Flow in Porous Media*, DOI: 10.1007/s11242-013-0171-9.
8. Painter SL, Gable CW., and **Kelkar S** 2011.Pathline tracing on fully unstructured control volume grids. *Comp. Geosciences* DOI 10.1007/s10596-012-9307-1.
9. **Kelkar S**, Mei Ding, Shaoping Chu, Bruce Robinson, Bill Arnold, and Arend Meijer, 2010. Modeling Solute Transport through Saturated Zone Ground Water at 10km Scale: Example from the Yucca Mountain License Application, Journal of Contaminant Hydrology. doi:10.1016/j.jconhyd.2010.05.003
10. Lichtner P, **Kelkar S**, Robinson BA, 2002, "New Form of Dispersion Tensor for Axisymmetric Porous Media with Implementation in Particle Tracking", *WRR*, **V38**, No. 8, 10.1029/2000WR000100, 2002.
11. Goff F, Goff S, **Kelkar S**, Shevenell L, Truesdell AH, Musgrave J, Rufenacht H, and Flores W. 1991. Exploration drilling and reservoir model of the Platanares Geothermal System, Honduras, Central-America. *J. of Volcanology and Geotherm. Res.* **Vol 45**, Iss 1-2, pp 101-123.

PUBLICATIONS IN PREPARATION FOR SUBMISSION TO PEER REVIEWED JOURNALS

1. **Kelkar S**, Karra S, Pawar R, 2013. Modeling coupled Thermo-Hydro-Mechanical processes including plastic deformation in geological porous media. In preparation for submission to *International Journal of Greenhouse Gas Control*.
2. **Kelkar S**, Pawar S, 2013. Comparison of simulations using fully implicitly coupled, sequentially coupled, and uncoupled methods for modeling coupled Thermal-Hydrological-mechanical processes in geomedia. In preparation for submission to *Computational Methods in Geoscisnces*.
3. Dempsey D, **Kelkar S**, Hickman S, Davatzes N, Moos D, 2013. Modeling Shear Stimulation of the EGS Well Desert Peak 27-15 Using a Coupled Thermal-Hydrological-Mechanical Simulator. In preparation for submission to *International Journal of Rock Mechanics and Mining Sciences*.
4. **Kelkar S**, Dempsey D, Hickman S, Davatzes N, Moos D. Evaluating the roles of thermoelastic and poroelastic stress changes in the Desert Peak EGS stimulation. In preparation for submission to *Geothemics*.
5. Pandey SN, Chaudhuri A, **Kelkar S**, Sandeep VR, and Rajaram H. Three dimensional Thermo-Hydro-Chemical (THC) modeling of transmissivity variation in a fractured reservoir due to silica dissolution/precipitation during heat extraction. *Geothermics*

OTHER PEER REVIEWED PUBLICATIONS

1. **Kelkar S**, Zyvoloski G, Rapaka S, Lewis K. 2011. Modeling shear failure and permeability enhancement due to coupled Thermal-Hydrological-Mechanical processes in Enhanced Geothermal Reservoirs. Transactions of the 2011 GRC annual meeting, San Diago, CA, October 2011.
2. **Kelkar S,** Zyvoloski G. 1991. An Efficient, Three-Dimensional, Fully Coupled Hydro-Thermo-Mechanical Simulator: FEHMS. SPE 21242.
3. **Kelkar S**, Dash Z, Malzahn M, Hendron R. 1987. Hydraulic and Thermal Behavior of a Hot Dry Rock Reservoir During a 30 Day Circulation Test. GRC Transactions Volume: 11 , pp 547-552 .
4. Ahmed U, Thompson W, **Kelkar S,** Veghte, Hathaway. 1984. Perforation Placement Optimization: a Modified Hydraulic Fracturing Technique. SPE 12841.
5. Jones A, Bush D, **Kelkar S,** Ahmed U, Bell. 1985. Performance Forecasting and Economic Evaluation of a Deeply Buried Coalbed Methane Reservoir in the San Juan Basin. SPE 14450.

CONFERENCE PRESENTATIONS AND OTHER PUBLICATIONS

1. Kelkar S, Carey JW, Dempsey D, Lewis K. 2014. A computational model of wellbore integrity applied to CO_2 sequestration. Presented at the Thirteenth Annual Carbon Capture, Utilization & Storage Conference, Pittsburgh, PA, 28 April – 01 May 2014.
2. Dempsey D, **Kelkar S**, Hickman S, Davatzes N, Moos D, Zemach E., 2014. Evaluating the roles of thermoelastic and poroelastic stress changes in the Desert Peak EGS stimulation. Presented at the Thirty-Ninth Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, February 24-26, 2014.
3. **Kelkar S**, Dempsey D, Hickman S, Davatzes N, Moos D, Zemach E., 2013. Comparison of Thermo-Elastic and Poro-Elastic effects during shear stimulation of Desert Peak EGS well 27-15 using a coupled Thermal-Hydrological-Mechanical simulator. Presented at the AGU Fall meeting, San Francisco, California, December 9-13, 2013.
4. Dempsey D, Pawar R., **Kelkar S,** 2013. Passive injection: a CO2 sequestration strategy that mitigates the threat of induced seismicity and brine migration. Presented at the AGU Fall meeting, San Francisco, California, December 9-13, 2013.
5. Stauffer P, Levine J, and **Kelkar S**, 2013. Shear failure during Injection of CO2 into Deep Ocean Sediments: Reservoir Engineering (Invited). Presented at the AGU Fall meeting, San Francisco, California, December 9-13, 2013.
6. Carey JW, Mori H, Porter ML, Lewis KC, **Kelkar S**, 2013. Experimental and computational studies of coupled geomechanical and hydrological processes in wellbore systems (invited). Presented at the AGU Fall meeting, San Francisco, California, December 9-13, 2013.
7. **Kelkar S,** Pogacnik J, Dempsey D, Zyvoloski G, Clearwater J. 2013. Investigation of mesh sensitivity in coupled thermal-hydrological-mechanical models: Examples from Desert Peak, Nevada, USA and Ngatamariki, New Zealand. Proceedings of the New Zealand Geothermal Workshop 2013 Proceedings, 17 -20 November 2013, Rotorua, New Zealand.
8. Dempsey DE, Clearwater J, **Kelkar S,** Wallis I. 2013. Validation of a coupled thermal-hydrological-mechanical model through a comparative study of shear stimulation in two geothermal environments: USA and New Zealand, 35th New Zealand Geothermal Workshop, Rotorua, New Zealand.
9. Dempsey D., **Kelkar S**., Lewis K., Hickman S., Davatzes N., Moos D., and Zymach E. Modeling shear stimulation of the EGS well Desert Peak 27-15 using a coupled Thermal-hydrological-Mechanical simulator. 47th US Rock Mechanics / Geomechanics Symposium held in San Francisco, CA, USA, 23-26 June 2013.
10. **Kelkar S**, Dempsey D, Hickman S, Davatzes N, Moos D. 2013. Modeling Shear Stimulation of the EGS Well Desert Peak 27-15 Using a Coupled Thermal-Hydrological-Mechanical Simulator. Presented at the Thirty-Eighth Workshop on Geothermal Reservoir Engineering, Stanford University, Stanford, California, February 11-13, 2013.
11. Hoda N, Fang C, **Kelkar S**, and Pawar R. 2012. Development of Numerical Simulation Capabilities for In Situ Heating of Oil Shale. Presented at the 32nd Oil Shale Symposium, October 2012, Golden, CO, USA.
12. **Kelkar S**, Karra S, Zyvoloski G, Pawar R, Rapaka S. 2012. Coupled plastic failure and permeability in rocks: a modeling approach. 46th US Rock Mechanics / Geomechanics Symposium held in Chicago, IL, USA, 24-27 June 2012.
13. Ding M, **Kelkar S**, Meijer A. 2011. Surface complexation modeling of actinide sorption in the saturated zone of yucca mountain. Presented at 13th International Conference on the Chemistry and Migration Behavior of Actinides and Fission Produces in the Geosphere", September 18-23, 2011, Beijing, China.

14. Pawar R, **Kelkar** S, Hoda N. 2011. Numerical simulation of coupled thermal-hydrological-mechanical-chemical processes during in situ conversion and processing of oil shale. Proceeding of the 2011 Oil Shale Symposium, October 2011, Golden, CO, USA.
15. **Kelkar S**, Rehfeldt K, Zyvoloski G, Kwicklis E, and Eddebbarh AA 2010. Geothermal: a viable and renewable energy. Presented at the International Nuclear and Renewable Energy Conference, Amman, Jordan, March 21-24, 2010.
16. Zyvoloski G, **Kelkar** S, Yoshioka K, Rapaka S. 2010. Thermal-hydrological-mechanical behavior of single fractures in EGS reservoir. AGU Fall 2010 Meeting, San Francisco, CA, USA. (LA-UR-10-05737).
17. Rapaka S, **Kelkar S**, Zyvoloski G, and Pawar R.2010. Thermal-hydrological-mechanical behavior of single fractures in EGS reservoir. AGU Fall 2010 Meeting, San Francisco, CA, USA.
18. **Kelkar** S 2010. Particle Tracking Methods. FEHM workshop, March 24026, 2010. Los Alamos National Laboratory, Los Alamos, New Mexico, USA.
19. **Kelkar S** et al. 2009. Investigating Coupled Thermal-Hydrological-Mechanical processes in Geothermal Reservoirs, 34th Stanford Geothermal Workshop, Stanford, California, February 9-11, 2009.
20. **Kelkar S**, WoldeGabriel GW, and Rehfeldt KR. 2009. A brief history with lessons learnt from the Hot Dry Rock geothermal energy program at Fenton Hill, New Mexico, USA. AGU Fall 2009 Meeting, San Francisco, CA, USA.
21. Arnold W, **Kelkar** S. 2008. Conceptual Model of Potential Radionuclide Transport in the Saturated Zone at Yucca Mountain, Nevada. Geological Society of America Annual Meeting, Houston, Texas, October 8, 2008.
22. Ding M, **Kelkar** S, Fabryka-Martin June T; et al. 2008. GEOC 113-Surface complexation modeling of radionuclide sorption in the saturated zone of Yucca Mountain rocks. 235th American-Chemical-Society National Meeting, New Orleans, LA, apr 06-10, 2008.
23. **Kelkar** S, Ding M, Chu S, Robinson B, Arnold B, and Meijer A 2008. An updated site scale saturated zone ground water transport model for Yucca Mountain. AIChE Annual Meeting, Philadelphia, PA, USA. Nov 16-21, 2008.
24. **Kelkar** S, Ding M, Chu S, Robinson B, Arnold B, and Meijer A. 2008. An updated site scale saturated zone ground water transport model for Yucca Mountain. 14th International High Level Radioactive Waste Management Conference, Las Vegas, Nevada, Sep 2007.
25. **Kelkar S**, et al. 2007, An Updated Site Scale Saturated Zone Ground Water Transport Model for Yucca Mountain, AGU Fall 2007 Meeting, San Francisco, CA, USA, Dec 10-14, 2007
26. **Kelkar S** et al. 2006, Saturated Zone Plumes in Volcanic Rock: Implications for Yucca Mountain, 13th International High Level Radioactive Waste Management Conference, Las Vegas, Nevada, April 2006.
27. Arnold BW, Meijer A, Kalinina E, Robinson BA, **Kelkar** S, Jove-Colon C, Kuzio SP, James S, Zhu M. Impacts of reducing conditions in the saturated zone at Yucca Mountain. Proceedings of the 11th International High-Level Radioactive Waste Management Conference (IHLRWM) 2006. pp. 345–352.
28. **Kelkar** S, Dash Z, Gable C, and Wolfsberg A. 2005, A Particle Tracking Method on Partially Structured Grids for Modeling Solute Transport in Ground Water, AGU Fall 2005 Meeting, San Francisco, CA, USA, Dec 2005.
29. **Kelkar** S, Dash ZV, and Arnold W, 2004, Site-Scale Saturated Zone Transport Model Predictions Using Alternate Flow Models at the Yucca Mountain Site, Geological Society of America Annual Meeting, Denver, Colorado, October 2004.
30. **Kelkar S**, et al. 2003, "Site/Subsite Scale Saturated Zone Flow-Transport Models for Yucca Mountain", 10th International High Level Radioactive Waste Management Conference, Las Vegas, Nevada, March 2003.
31. **Kelkar** and Zyvoloski, 1990, 31st US Symp Rock Mech, Hydro-Thermo-Mechanical Response of a Fractured Rock Block.
32. Kuriyagawa H, Yamaguchi S, Zyvoloski G, and **Kelkar** S. 1987. Prediction of hydraulic fracture extension by a finite element model. 6th ISRM Congress, Montreal, Canada. Aug 30- Sep 3, 1987.
33. **Kelkar** S, Murphy H, and Dash ZV. 1986, 27th US Symp Rock Mech, Earth Stress Measurements in Deep Granitic Rock.
34. **Kelkar S**, Zyvoloski GA, and Dash ZV. 1986. Pressure testing of a high temperature naturally fractured reservoir. 11th Workshop on Geothermal Reservoir Engineering at Stanford University, Stanford, CA.
35. Jones AH, Ahmed U, Bush DD, Holland MT, **Kelkar** S, Rakop KC, and Bowman KC. 1984. Methane production characteristics of a deeply buried coalbed reservoir in the San Juan Basin. SPE 12876-MS. SPE Unconventional Gas Recovery Symposium, 13-15 May 1984, Pittsburgh, Pennsylvania.

36. Ahmed U, Thompson TW, and **Kelkar** S. 1984. Performance placement optimization: a modified hydraulic fracturing technique. SPE/DOE/GRI 12841. Unconventional Gas Recovery Symposium, Pittsburgh, PA, USA. May 13-15, 1984.
37. Ahmed U, Hathaway S, **Kelkar** S., Strawn JA, Thompson TW, Veyhte R. 1984. Optimizing hydraulic fracture designs in formations with poor containment. SPE 13375, Eastern regional meeting of the Society of Petroleum Engineers, Charlestown, WV, USA, 31 Oct 1984.
38. **Kelkar e**t al., 1983, 24th US Symp Rock Mech, Long-Term Stress Related Drainage Behavior of a Low Permeability Rock Simulant.
39. **Kelkar S**, Cooley CH, and Schatz JF 1983. SPE 12191, Mechanical Properties of Geopressured Core and Their Influence on Reservoir Performance: T-F&S/DOE Gladys McCall No.1 Well.
40. Ahmed, **Kelkar S,** Schatz. 1983. Mini Frac: an Aid to Formation In Situ Stress and Permeability Measurements. 24th US Symp Rock Mech.
41. **Kelkar S**, 1983. Flow of supersaturated gas-liquid mixtures through porous media. SPE 11923-MS
42. Byrnes AP, Rockar EM, Randolph PL, and **Kelkar** S. 1979. Geopressured aquifer simulator. 4th US Gulf Coast geopressured-geothermal energy conference, University of Texas at Austin, Austin, Texas, October 29-31, 1979.

PROJECT REPORTS

1. **Kelkar** S. 2011. Monthly Reports from January to August 2011. Monthly Reports for LANL activities for 2011 for Exxon-Mobil CRADA. Exxon-mobil CRADA: No. LA08C105940PTS-002.
2. **Kelkar S**., WoldeGabriel G., and Rehfeldt K., 2011. Hot Dry Rock Geothermal Energy Development at Los Alamos National Laboratory: 1070-1995, Final Report. Los Alamos National Laboratory report LA-14433-HDR, February 2011, Los Alamos, New Mexico, USA.
3. **Kelkar S**. 2010. Monthly Reports from September to December 2010. Monthly Reports for LANL activities for 2010 for Exxon-Mobil CRADA. Exxon-mobil CRADA: No. LA08C105940PTS-002.
4. **Kelkar S** et al, 2008. Site-Scale Saturated Zone Transport. MDL-NBS-HS-000010 REV 03 AD 01. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20080121.0003; DOC.20080117.0002; DOC.20090115.0001; DOC.20090609.0001.
5. Lichtner P.C., **Kelkar S**., and Robinson B., 2008. Critique of Burnett-Frind dispersion tensor for axisymmetric porous media. Los Alamos National Laboratory report LA-UR-08-4493.
6. **Kelkar S** et al. 2004. Site-Scale Saturated Zone Transport. MDL-NBS-HS-000010 REV 02, BSC 2004 [DIRS 170036]. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20041103.0004; DOC.20050405.0008KELKAR S.M. 1990.
7. **Kelkar S** 1990, Hot Dry Rock research: A compendium of publications for October 1988-September 1989. Los Alamos National Laboratory Report LAUR-90-230, 1990.
8. Dash, Z. V., R. G. Aguilar, B. R. Dennis, D. S. Dreesen, M. C. Fehler, R. H. Hendron, L. S. House, H. Ito **Kelkar S**, M. V. Malzahn, J. R. Miller, H. D. Murphy, W. S. Phillips, S. B. Restine, P. M. Roberts, B. A. Robinson, and W. R. Romero. 1989. "ICFT: An initial closed-loop flow test of the Fenton Hill Phase III HDR reservoir." Los Alamos National Laboratory report, LA-11498-HDR, DE89007286.
9. Zyvoloski. G A., Dash. Z. V., **Kelkar S**. 1988. Fehm-finite element heat and mass transfer code. Los Alamos National Laboratory, Report No. LA-11224-MS.
10. Thompson T.W., **Kelkar** S.M., and Gray K.E. 1979. Effect of pore pressure on the elastic moduli, porosity and permeability of Berea sandstone and Leuders limestone. OSTI 5733334, DOE/ET/28462-1.