Ajay Malkoti

Curriculum Vitae

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🖥 https://ajmalkoti.github.io/

Research Interests

Exploration Seismic, Seismic wave propagation, Upscaling methods, Waveform based imaging methods, Inverse methods, Numerical methods

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Research Experience

2021-Present **Scientist** at the CSIR-National Geophysical Research Institute, Hyderabad, Telangana-500007, India.

2019 -2021 **Post-doctoral fellow** at the Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai 400005, India

In collaboration with Shell Global Solutions International B.V., Netherlands.

Jan-Mar 2019 **Project-Scientist**, CSIR-NGRI, Hyderabad, India.

Education

2013–2019 **Ph.D. in Physical Sciences (Geophysics)**, Academy of Scientific and Innovative Research, at CSIR-National Geophysical Research Institute, Hyderabad, Telangana, India.

2010–2012 **Master of Science (Geophysics)**, Indian Institute of Technology Kharagpur, West Bengal, India.

2006–2009 **Bachelor in Applied Physical Science (Electronics)**, University of Delhi, New Delhi, India.

Projects

2024-present Title: Quantification of detection threshold and sensitivity of seismic techniques for monitoring of CO2 storage sites in India; Duration: 3 years (2024-2027); Role: co-PI; Sponsoring agency: Department of Science and Technology. (Yet to start)

Aug 2022-Jul 2024 Title: A fractional Gaussian fractal based seismic inversion package for the high resolution subsurface image; Duration: 2 years (Aug 2022-July 2024); Role: PI; Sponsoring agency: Council of Scientific and Industrial Research.

Awards and Recognitions

Oct 2016 Travel Grant for Student Education Program, Katowice, Poland awarded by Society of Exploration Geophysicist, USA

Jul 2016 Travel Grant for Student Leadership Program, Dallas, USA awarded by Society of Exploration Geophysicist, USA

Oct 2015 Travel Grant for SEG Annual Meeting, New Orlean, USA awarded by Society of Petroleum Geophysicist, North America

Jan 2015 Senior Research Fellowship awarded by CSIR-UGC India

Jan 2013 Junior Research Fellowship awarded by CSIR-UGC India

Teaching and Supervision

I taught following graduate level courses to PhD students registered in AcSIR, NGRI.
- Geophysical Inverse Theory, Jan-July 2021
- Advance Seismic Methods, Jan-July and Jan-July 2023
- Research Methodology, Aug-Dec 2022
- Numerical Methods for Geoscientists, Jan-July 2024

Mentorship

Doctoral candidate(s) at AcSIR (NGRI)
- Joseph Lalngaihawma (JRF). Developing machine learning based seismic inversion.

Postdoc candidate(s)
- Dr. Srishti Singh. Developed fractal based seismic inversion method. (Now at IIT Jammu.)
- Dr. Sanjay Singh. Developed bandlimited impedence inversion method.

Project associate(s)
- Ms. Sreeja Kalyankar. Developing GUI interface, utilities, etc. for seismic inversion package.
- Mr. Arkajit Chakrabarti. Processing coal-field seismic data. (Now at GSI)

Codes Developed

(Open Source)

FDwave A MATLAB package for seismic wave simulation in 2D acoustic/elastic/viscoelastic media. URL https://github.com/ajmalkoti/FDwave

FDwave3D A MATLAB package for seismic wave simulation in 3D anisotropic media (in collaboration with Lei Li, Central South University: Changsha, China, and other). URL https://github.com/ajmalkoti/FDwave3D

FRAMCA A MATLAB package for modeling the permeability of sandstone reservoir (based upon fractal nature of tortuous capillary tubes and pore distribution) using GR and Density logs (in collaboration with U.Vadapalli, CSIR-NGRI). URL https://github.com/ajmalkoti/FARMCA

(Private codes)

SeisImage A python package for carrying out the seismic inversion using the fractal characteristics of the geophysical log. The code is yet to be filed for copyright/patent.

UWave A MATLAB based code package for upscaling of 2D acoustic wave including reverse time migration (RTM). This code has been extended for elastic wave as well (under testing).

ImpWave A MATLAB package for 3D seismic wave simulation in using implicit finite difference operator. This code has been improved for accuracy and published in collaboration with S. Kumawat and S.k. Vishwakarma, BITS Hyderabad

CCHVR A Python package for simulation of multicomponent ambient noise cross correlations and determination of H/V ratio using respective components. (In collaboration with A. Dutta and S.M. Hanasoge, TIFR)

GALog A C/MATLAB code for estimation of petrophysical parameters from logs using Genetic Algorithm.

Invited Talks

Nov 2023 Malkoti, A., Vedanti, N., (2023). "Application of Seismic Exploration Techniques in Exploration of Unconventional Hydrocarbons and CCS projects". In: International Conference on Petroleum, Hydrogen and Decarbonization. Society of Petroleum Engineers. IIT Guwahati, Assam, India.

Nov, 2022 "Modern seismic data acquisition", In: workshop on "Geophysical Data Processing based on Signal Processing and Deep Learning Techniques", SRM-university.

Jan 2022   Application of Seismic method for characterizing Coal field, Aspentech, User group meeting, Mysore.

Sep, 2021   "Seismic modeling and Upscaling". In one-day Seminar on "Seismic Reservoir Characterization (Seismic Modelling, Acquisition, Processing, Interpretation, Rock Physics and Property Estimation for EOR and CO2 Sequestration)", organized by Oil and Gas Research Center, Persian Gulf University.

Publications

Articles   in preparation/submission

- Malkoti, A., Illa, B. Hanasoge, S.M., Plessix, R. E. Upscaling Elastic wave equation using Renormalization group theory.

- Singh, S., Kalyankar, S., Malkoti, A., Vedanti, N. An application of Gaussian Fractal based Stochastic seismic inversion to F3-Netherlands dataset.

- Singh, S., Kalyankar, S., Singh. S., Malkoti, A., Vedanti, N. A comparitive study of Fractal based inversion and bandlimited impedance inversion.

- Malkoti, A. Present status and challenges in seismic inversion.

Copyright/   Patent under preparation

Ajay Malkoti, Nimisha Vedanti, Gaussian Fractal based stochastic seismic inversion method

Articles   (Published)

- Kumawat, S., Malkoti, A., Vishwakarma, S. K. (2024). A cell-centered implicit finite difference scheme to study wave propagation in acoustic media: A numerical modeling. *Journal of Sound and Vibration*. ,590, 118601 `DOI:10.1016/j.jsv.2024.118601`

- Vadapalli, V.Uma, Malkoti, A., Vedanti, N.; Dimri, V.P.; Guruhappa, H., (2022), Field scale and site-specific permeability of sandstone reservoirs using a stabilized Monte–Carlo algorithm: A case study, *Geophysics*. ,87(6):B337–B350, `DOI:10.1190/geo2022-0255.1`

- Malkoti, A., Hanasoge, S.M., R. E. Plessix, (2022), Upscaling acoustic wave equation using Renormalization Group theory. *Geophysics*. 87(4):T281–T290, `DOI:10.1190/geo2021-0572.1`

- Malkoti, A., Dutta, A., Hanasoge, S.M., (2021), Rayleigh wave H/V ratio measurement from ambient noise cross-correlations, and its sensitivity to Vp: a numerical study, *Geophysical Journal International*, v.227(1), pp.472-482. `DOI:10.1093/gji/ggab228`

- Li, L., Tan, J., Zhang, D., Malkoti, A., Abakumov, I. & Xie, Y., (2021), FDwave3D: A MATLAB solver for the 3D anisotropic wave equation using the finite-difference method. *Computational Geosciences*. `DOI:10.1007/s10596-021-10060-3`

- Malkoti, A., Vedanti, N., Tiwari, R.K., (2019), A highly efficient implicit finite difference scheme for acoustic wave propagation, *Journal of Applied Geophysics*. v.161, pp.204-215. `DOI:10.1016/j.jappgeo.2018.12.017`

- Malkoti, A., Vedanti, N., and Tiwari, R. K. (2018). An algorithm for fast elastic wave simulation using a vectorized finite difference operator. *Computers & Geosciences*., v.116, pp.23-31. `DOI:10.1016/j.cageo.2018.04.002`

- Vedanti, N., Malkoti, A., Pandey, O. P., and Shrivastava, J. P. (2018). Ultrasonic P- and S-wave attenuation and petrophysical properties of deccan flood basalts, India, as revealed by borehole studies. *Pure and Applied Geophysics*, v.175(8), pp.2905-2930. `DOI:10.1007/s00024-018-1817-x`

- Vedanti, N., Malkoti, A., (2019), Viscoelastic seismic modeling and Q estimation for an attenuating media. *Journal of Indian Geophysical Union*, v.23(1), pp.3-9

- Malkoti, A., Vedanti, N., Bhattacharaya, A. K., (2017). Inversion of well log data using improved shale model for determination of petrophysical parameters. *Journal of Indian Geophysical Union*, v.21(2), pp.96-104.

Conference

- Kumar, P., George, N., Ahmed, S., Malkoti, A., Sinha, S., Vedanti, N., Dhar, R., (2024). "Structural model of coal-bearing Raniganj Formation derived from petrophysical data in the Raniganj (E) block, India". In: National Conference on Rock Deformation and Structures (RDS). Structural Geology and Tectonic Studies Group India. IISER Bhopal, 22-24 October.

- Kumar, P., Malkoti, A., Vedanti, N., (2024). "Geological sequestration of the CO2 in the potential coal seams from the Raniganj basin". In: Role of Geosciences in Carbon Storage. Society of Exploration Geophysicist.Mumbai India.

- Singh, S., Kalyankar, S., Malkoti, A., Vedanti, N., (2024). "Application of fractional Gaussian Fractal-Based Stochastic Seismic Inversion to F3-Netherland dataset". In: International Meeting for Applied Geoscience and Energy. Society of Exploration Geophysicist and American Association of Petroleum Geologists i. Houston,Texas, 26-29 August.

- Vadapalli, U., Malkoti, A., Vedanti, N., (2024). "Challenges in permeability prediction concerning geological carbon sequestration: A case study from Ankleshwar oil field, India". In: Role of Geoscience in Carbon Storage. Society of Exploation Geophysicist. Mumbai, India.

- Malkoti, A., Datta, A., Hanasoge, S., (2020). "H/V amplitude ratio measurement using multicomponent ambient noise cross-correlations and its relationship to Vp/Vs". In: AGU Fall Meeting 2020. American Geophysical Union. Virtual/Online, S019–0010.

- Malkoti, A., Vedanti, N., (2019). "Efficient seismic simulation for a highly attenuating media". In: IUGG 27th General assembly. International Union of Geodesy and Geophysics. Montreal, Canada 08-18 Jul 2019.

- Vedanti, N., Malkoti, A., (2019). "Petrophysical characterization of two formations of Deccan flood basalt for improved sub-basalt imaging". In: IUGG 27th General assembly. International Union of Geodesy and Geophysics. Montreal, Canada, 08-18 Jul 2019.

- Malik, R., Malkoti, A., Vedanti, N., Dimri, V., (2017). "1-D Full waveform inversion using micro genetic algorithm." In: AEG 39th Annual Convention. Association of Exploration Geophysicist. Banaras Hindu University, Varanasi, India.

- Malkoti, A., Vedanti, N., Tiwari, R. K., (2017). "High fidelity numerical simulation for scalar wave". In: AEG 39th Annual Convention. Association of Exploration Geophysicist. Banaras Hindu University, Varanasi, India.

- Malkoti, A., Vedanti, N., Kunagu, P., Tiwari, R., (2015). "Modeling viscoelastic seismic wave propagation in Deccan flood basalt, western India". In: SEG International Exposition and Annual Meeting. Society of Exploration Geophysicist. New Orleans, Louisiana, USA. 18-23 October 2015, pp. 3274–3278. doi: 10.1190/segam2015-5898555.1.

- Vedanti, N., Malkoti, A., Dutta, S., Pandey, O., (2015). "Elastic properties of ambenali and poladpur formations of DVP: New findings". In: National conference on Paleogene of the Indian Subcontinent. Birbal Sahni Institute for Palaeobotany, Lucknow, 23-24 April 2015.

- Vedanti, N., Lakshmi, K., Dutta, S., Malkoti, A., Pandey, O., (2015). "Investigation of petrophysical properties and ultrasonic P-and S-wave attenuation in Deccan Flood Basalts, India". In: SEG International Exposition and 85th Annual Meeting. Society of Exploration Geophysicist. New Orleans, Louisiana, USA. 18-23 October 2015, pp. 3274–3278. doi: 10.1190/segam2015-5858683.1.

- Malkoti, A. (2014). "Inversion of well log data for better determination of petrophysical parameters". In: IGU 51st Annual convention. Indian Geophysical Union. Kurukshetra University, Haryana, India, 19-21 November 2014, p. 198.