Curriculum Vitae – Vladimir V. Kazei

Personal Information

Vladimir V. Kazei
Date of birth:
February 18, 1988
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I always enjoyed solving tricky mathematical problems and first participated in a Mathematical Olympiad when I was ten. I received several awards for my achievements in mathematical competitions during high school and university. In graduate school, I discovered geophysics, which allows me to apply my mathematical skills and knowledge to practical problems. During my PhD studies, I analyzed model wavenumber coverage in acoustic full-waveform inversion, coded it in the pseudo-spectral domain and upgraded its convergence by introducing efficient gradient filtering.

As a postdoc, I am trying to solve seismic inverse problems with anisotropic full-waveform inversion (FWI), Sobolev space norm–based regularizations and machine learning.

Research interests

Geophysics; inverse problems, deep learning, full waveform inversion; seismic modeling and inversion for anisotropy; edge-preserving regularization methods; inversion for low spatial wavenumbers in seismic velocity models

Education

PhD in Geophysics, The Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences (IPE RAS) / Saint Petersburg State University (2012-2016). Thesis advisor: Boris M. Kashtan (SPSU, Faculty of Physics, Earth's Physics Department). Thesis title: *Pseudo-spectral full-waveform inversion in acoustic media.*

Master of Sciences in physics with distinction from Saint Petersburg State University (2009-2012). Thesis advisor: Boris M. Kashtan (SPSU, Faculty of Physics, Earth's Physics Department). Thesis title: *Investigation of possibility to use head waves for inhomogeneity reconstruction in acoustic media.*

Bachelor of Sciences in physics with distinction from Saint Petersburg State University (2005-2009). Thesis advisor: Nikolay D. Filonov (SPSU, Faculty of Physics, Department of Mathematical Physics). Thesis title: *Investigation of zero set of the Fourier transform of a 2D characteristic function.*

Saint Petersburg Lyceum 533 (2003-2005) High school. Mathematical class.

Experience

2016 → **Postdoctoral researcher** at King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Department (PSE) Seismic Wave Analysis Group (SWAG),
Research on anisotropic elastic waveform inversion, regularizations and machine learning. I closely collaborate with and help supervise PhD students Mahesh Kalita (regularizations for salt inversion) and Oleg Ovcharenko (machine learning for seismic inversion). Apart from doing research and writing papers, I work on project proposals to acquire additional funding for the seismic wave analysis group led by Prof. Tariq Alkhalifah. You can check https://github.com/vkazei for the latest open software I worked on.

2010 → 2016 Engineer-researcher (geophysicist) at Saint Petersburg State University, Faculty of Physics, Earth's Physics Department,
Laboratory of Elastic Media Dynamics
Seismic data modeling, processing and inversion.

2011 → 2015 Student participant in "Full-waveform inversion" project sponsored by Shell Global Solutions International B.V.
Mathematical derivations and scientific programming in order to obtain deeper understanding of how FWI works. Developed wavenumber illumination theory to uncover the roles of multiples and head waves in FWI together with Prof. Wim Mulder of Shell.

Collaborations

2013 → 2016 Visiting-researcher (geophysicist) at University of Hamburg, Institute of Geophysics, Chair of Applied Seismics
Development of "Pseudo-spectral seismic waveform inversion" codes.

2014, October Visiting-researcher (geophysicist) at Colorado School of Mines, Department of Geophysics, Center for Wave Phenomena
Extended imaging for FWI

2015, March-April Visiting-researcher (geophysicist) at KAUST, Department of Earth Science and Engineering, Seismic Wave Analysis Group (SWAG), Development of efficient scattering angle–based filtering for FWI.

2018, October-December Visiting-researcher (geophysicist) at Princeton University, Theoretical and Computational Seismology Group, Department of Geosciences. Development of wavelet–based model generator for deep learning applications to seismic inverse problem with Prof. Fredrik J. Simons

Soft skills

Matlab, C, Python, Linux (Debian, CentOS), Microsoft Office, bash and tcsh, LaTeX 2_ε, Madagascar, Tensorflow, Keras

Professional affiliation

Society of Exploration Geophysicists (SEG), European Association of Geoscientists and Engineers (EAGE), American Geophysical Union (AGU).

Language skills

Russian: Native speaker; **English**: Fluent; **German**: Basic.

Honors & Awards

- 1st place in KAUST GPU Hackathon 2017, 2018
- Award for excellence in geoscience of Government of St. Petersburg, 2015
- SEG student scholarship award, 2015
- Winner of Olympiads in Mathematics and Physics (St. Petersburg 2003-2005)

Hobbies

windsurfing, water polo, swimming

Pier reviewed publications

Journal papers

- Vladimir Kazei, Tariq Alkhalifah; Scattering Radiation Pattern Atlas: What anisotropic elastic properties can body waves resolve?, Journal of Geophysical Research: Solid Earth, 2019, accepted
- Oleg Ovcharenko, Vladimir Kazei, Mahesh Kalita, Daniel Peter, Tariq Alkhalifah, Shot-to-shot low-frequency extrapolation for FWI by a deep convolutional neural network, Geophysics, 2019 submitted
- Mahesh Kalita, Vladimir Kazei, Yunseok Choi, Tariq Alkhalifah, 2019: Full waveform inversion with automated salt-flooding, Geophysics, minor revision submitted
- Yuriy Ivanov, Alexey Stovas, Vladimir Kazei; Normal modes in orthorhombic media, Geophysical Journal International, Volume 216, Issue 3, 1 March 2019, Pages 1785-1797, https://doi.org/10.1093/gji/ggy534
- Vladimir Kazei, Tariq Alkhalifah; Waveform inversion for orthorhombic anisotropy with P waves: feasibility and resolution, Geophysical Journal International, Volume 213, Issue 2, 1 May 2018, Pages 963-982, https://doi.org/10.1093/gji/ggy034.
- Oleg Ovcharenko, Vladimir Kazei, Daniel Peter, and Tariq Alkhalifah (2018). Variance-based model interpolation for improved full-waveform inversion in the presence of salt bodies. Geophysics, 83(5), R541-R551, https://doi.org/10.1190/geo2017-0575.1
- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Ekkehart Tessmer, Pseudo-spectral full-waveform inversion, Seismic Technology, 2015 (2), pages 18-28 (in Russian)
- Denis Anikiev, Vladimir Kazei, Boris Kashtan, Andrey Ponomarenko, Vladimir Troyan, Renat Shigapov, Methods of seismic waveform inversion, Seismic Technology, 2014, 12(1), pages: 38-58. (in Russian)
- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Wim Mulder, On the role of reflections, refractions and diving waves in full waveform inversion // Geophysical Prospecting, 2013, 61(6), pages: 1252-1263, doi:10.1111 1365-2478.12064.

Expanded abstracts:

- Vladimir Kazei, Tariq Alkhalifah; Time-lapse waveform inversion regularized by spectral constraints and Sobolev space norm SEG Technical Program Expanded Abstracts 2018, 5487-5491
- Mahesh Kalita, Vladimir Kazei, Yunseok Choi, Tariq Alkhalifah, Regularized full-waveform inversion for salt bodies SEG Technical Program Expanded Abstracts 2018, 1043-1047
- Oleg Ovcharenko, Vladimir Kazei, Daniel Peter, and Tariq Alkhalifah Variance-based model interpolation for improved full-waveform inversion in the presence of salt bodies Geophysics 83 (5), 1-60
- Oleg Ovcharenko, Vladimir Kazei, Daniel Peter, Xianliang Zhang and Tariq Alkhalifah Low-Frequency Data Extrapolation Using a Feed-Forward ANN 80th EAGE Conference and Exhibition 2018
- Mahesh Kalita, Vladimir Kazei, Yunseok Choi, Tariq Alkhalifah, Full-Waveform Inversion for Automated Salt Flooding 80th EAGE Conference and Exhibition 2018
- Vladimir Kazei, Tariq Alkhalifah; Resolving Orthorhombic Anisotropy with the Addition of PS Conversions 80th EAGE Conference and Exhibition 2018
- Vladimir Kazei, Masmoudi, N., Oh, J. W., Tzivanakis, C., & Tariq Alkhalifah, T. (2017). From CPU to GPU in Two Days: 3D Elastic Orthorhombic Modeling with OpenAcc. In Third EAGE Workshop on High Performance Computing for Upstream.
- Vladimir Kazei and Tariq Alkhalifah (2017) Regularized Centered Differential Waveform Inversion, presented at the AGU annual meeting in New Orleans, USA
- Oleg Ovcharenko, Vladimir Kazei, Daniel Peter, and Tariq Alkhalifah (2017), Super-resolution time-lapse seismic waveform inversion, to be presented at the AGU annual meeting in New Orleans, USA
- Vladimir Kazei, Tariq Alkhalifah; (2017a). Centered differential waveform inversion with minimum support regularization. In 79th EAGE Conference and Exhibition 2017.
- Vladimir Kazei, Tariq Alkhalifah; (2017b). On the resolution of inversion for orthorhombic anisotropy. In 79th EAGE Conference and Exhibition 2017.
- Vladimir Kazei, Tariq Alkhalifah; (2017). Salt-body inversion with minimum gradient support and sobolev space norm regularizations. In 79th EAGE Conference and Exhibition 2017.
- Oleg Ovcharenko, Vladimir Kazei, Daniel Peter, and Tariq Alkhalifah, T. (2017). Variance-based salt body reconstruction. In 79th EAGE Confer- ence and Exhibition 2017.
- Vladimir Kazei, Ekkehart Tessmer, and Tariq Alkhalifah (2016) Scattering angle-based filtering via extension in velocity. SEG Technical Program Expanded Abstracts 2016: pp. 1157-1162. doi: 10.1190/segam2016-13870908.1
- Vladimir Kazei, Ekkehart Tessmer, and Tariq Alkhalifah (2016) Efficient Deflection Angle Based Filtering for Waveform Inversion. In 7th EAGE Saint Petersburg International Conference and Exhibition.

- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Wim Mulder, FWI spectral sensitivity analysis in the presence of a free surface // SEG International Exposition and 85th Annual Meeting in New Orleans 2015, Louisiana
- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Wim Mulder, Free-surface Multiples and full-waveform inversion spectral resolution // 77th EAGE Conference and Exhibition 2015, oral presentation
- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Wim Mulder, FWI sensitivity analysis in the presence of free-surface multiples// 2013 SEG Workshop, Muscat, Oman, Full Waveform Inversion: From Near Surface to Deep, oral presentation.
- Vladimir Kazei, Boris Kashtan, Vladimir Troyan and Wim Mulder, Spectral sensitivity analysis of FWI in a constant-gradient background velocity model// EAGE Conference London 2013 Expanded Abstracts presented as poster Tu-P04-11.
- Vladimir Kazei, Andrey Ponomarenko, Boris Kashtan, Vladimir Troyan and Wim Mulder, On the contribution of head waves to full waveform inversion// EAGE Conference Copenhagen 2012 Expanded Abstracts presented as poster P341.

References

Prof. Dr. Tariq Alkalifah (supervisor at KAUST),
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Prof. Dr. Paul Sava (collaboration on extended imaging for FWI),
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Prof. Dr. Frederik Simons (collaboration on wavelet domain, ML based, waveform inversion),
Theoretical and Computational Seismology Group, Department of Geosciences, Princeton University, E-mail : fjsimons@princeton.edu; Tel: +1 609 258 2598