

Alison E. Malcolm

Assistant Professor

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Education

- PhD in Geophysics, with a Mathematics minor, at the Colorado School of Mines with the Center for Wave Phenomena, advisor Prof. M.V. de Hoop, co-advisor Prof. J. A. Scales, May 2005.
- Bachelor of Science in Geophysics (honors), University of British Columbia, May 2000.

Professional Experience

- Currently an assistant professor in the Earth, Atmospheric and Planetary Sciences Department at MIT, beginning January 2008.
- 2006-2007: Postdoctoral researcher in the Earth Sciences Department at Utrecht University, working primarily with J. Trampert.
- 2005-2006: Postdoctoral fellow at the Institute for Mathematics and its Applications, at the University of Minnesota, participating in the annual program on imaging.
- 2000-2005: Research assistant at the Center for Wave Phenomena (Colorado School of Mines), primarily supervised by M. V. de Hoop and J. A. Scales.
- Summer 2002: Internship with Total in Pau, France, supervised by H. Calandra.
- Spring 2001: Teaching assistant for the Colorado School of Mines Department of Geophysics Field Camp, supervised by M. L. Batzle.
- Summer 1999: Research assistant as part of the NSERC Undergraduate Summer Research Program at the University of British Columbia, supervised by T. J. Ulrych.
- Summer 1997 and 1998: Field/research assistant for the LITHOPROBE project at the University of British Columbia, supervised by R. M. Clowes.

Research Interests

- Imaging complex structures.
- The mathematics of inverse scattering, in particular microlocal analysis.
- Multiple scattering in granular media.

Current Projects

- Extending the illuminated region of the Earth from a particular experiment utilizing multiply scattered waves, with B. Ursin and M. V. de Hoop.
- Understanding the implications and underlying physics of wavefront healing, with J. Trampert.

- The modeling of vibro-acoustography, a new medical imaging modality, with F. Reitich, J. Yang, J. Greenleaf and M. Fatemi.
- The computation of topological sensitivity in the time domain with B. Guzina.

Publications

In Preparation

- A. E. Malcolm, B. Ursin and M. V. de Hoop *Seismic image and illumination enhancement with multiply scattered waves*.
- A. E. Malcolm, F. Reitich, J. Yang, J. F. Greenleaf and M. Fatemi, *Ultrasound Vibro-Acoustography: A numerical model* being prepared for a special edition of Ultrasonics.
- A. E. Malcolm and B. Guzina *On the Topological Sensitivity of Transient Acoustic Fields* submitted to Wave Motion.

Refereed Publications

- A. E. Malcolm, M. V. de Hoop and H. Calandra, *Identification of Image Artifacts due to Internal Multiples*, Geophysics **72** (2007).
- A. E. Malcolm, F. Reitich, J. Yang, J. F. Greenleaf and M. Fatemi, *A Complete Computational Model of Ultrasound Vibro-Acoustography*, ASME-Publications-BED **58** (2006).
- A. E. Malcolm and M. V. de Hoop, *A Method for Inverse Scattering Based on the Generalized Bremmer Coupling Series*, Inverse Problems **21** (2005)
- A. E. Malcolm, M. V. de Hoop and J. H. Le Rousseau, *The Applicability of DMO/AMO in the Presence of Caustics*, Geophysics **70** (2005).
- A. E. Malcolm, J. A. Scales and B. A. van Tiggelen, *Extracting the Green Function from Diffuse, Equipartitioned Waves*, Phys. Rev. E **70** (2004).
- M. V. de Hoop, A. E. Malcolm and J. H. Le Rousseau, *Seismic Data Continuation in the Single Scattering Approximation: A Framework for Dip and Azimuth Moveout*, Can. Appl. Math. Q. **10** (2003).
- J. A. Scales and A. E. Malcolm, *Laser Characterization of Ultrasonic Wave Propagation in Random Media*, Phys. Rev. E **67** (2003).

Book Chapter

- A. E. Malcolm, F. Reitich, J. Yang, J. F. Greenleaf and M. Fatemi, *Numerical Modeling for Assessment and Design of Ultrasound Vibroacoustography Systems in Biomedical Applications of Vibration and Acoustics in Imaging and Characterisations* editors: M. Fatemi, A. Al-Jumaily and A. Alizad.

Theses

- PhD Thesis: Data Regularization for Data Continuation and Internal Multiples, advisor M.V. de Hoop.
- B.Sc. Honors Thesis: Algorithm Development for the Fast Computation of the Fourier Transform of Unequally Sampled Data with Applications to Seismic and Sediment Core Data, advisor T. J. Ulrych.

Recent Conference Presentations

- *Acoustic Obstacle Reconstruction with the Time Domain Topological Derivative*, Presented at the COMPDYN meeting June 13-16, 2007, with B. Guzina.
- *A Series Approach to Multiple Scattering*, Presented at the Canadian Applied and Industrial Mathematics Society Annual Meeting, May 20-24, 2007, with M. de Hoop and B. Ursin.
- *A Complete Numerical Model of Ultrasound Vibro-Acoustography*, Invited presentation at the International Conference on Ultrasound, April 10-12, 2007, with F. Reitich, J. Yang, J. Greenleaf and M. Fatemi.
- *Amplitude Corrections for Estimating Imaging Artifacts from Multiples*, Contributed presentation to the 2006 Pacific Institute for the Mathematical Sciences Geophysical Inversion Workshop, August 14-18, 2006, with M. V. de Hoop.
- *Virtual Ultrasound Vibro-Acoustography*, Poster presentation at the Imaging Communication and Disorder summer school, June 12-17, 2006, with F. Reitich, J. Yang, J. Greenleaf and M. Fatemi.
- *Virtual Ultrasound Vibro-Acoustography*, Contributed presentation at the Society for Industrial and Applied Mathematics Conference on Imaging Science, May 15-17, 2006, with F. Reitich, J. Yang, J. Greenleaf and M. Fatemi.
- *Estimating Imaging Artifacts Caused by Leading-Order Internal Multiples*, Poster presentation at the Institute for Mathematics and its Applications workshop on “Imaging from Wave Propagation”, October 17-21, 2005, with M. V. de Hoop and H. Calandra.
- *The Transition to Equipartitioning and its Relation to Scattering Strength*, Invited presentation at the annual meeting of the Acoustical Society of America, 2005, with J. A. Scales and B. A. van Tiggelen.
- *Inverse Multiple Scattering*, Poster presentation at the annual meeting of the American Geophysical Union, 2004, with M. V. de Hoop.
- *Estimating Scattering Strength from the Transition to Equipartitioning*, Poster presentation at the annual meeting of the American Geophysical Union, 2004, with J. A. Scales and B. A. van Tiggelen.
- *Data Continuation in the Presence of Caustics: A Synthetic Data Example*, Oral presentation, SEG 2004, expanded abstract in expanded abstract book, pages 1293-1296, with M. V. de Hoop.
- *Inverse Multiple Scattering in the Downward Continuation Approach*, Oral presentation, SEG 2004, expanded abstract in expanded abstract book, pages 2060-2063, with M. V. de Hoop.

Awards

- American Geophysical Union (AGU) outstanding student paper award, at the AGU annual meeting, 2004.
- Society of Exploration Geophysicists (SEG) award of merit for student paper competition at the SEG annual meeting, 2003.
- Society for Industrial and Applied Mathematics (SIAM) student travel award to attend SIAM Conference on Mathematical and Computational Issues in the Geosciences, 2003.
- SEG student travel grant to attend the SEG annual meeting, 2002.
- Named a Science Scholar (top 20 students in the Faculty of Science) at the University of British Columbia, 1998-2000.
- Received a Natural Science and Engineering Research Council (NSERC) Undergraduate Summer Research Award, summer 1999.

Teaching Experience

- Substitute Instructor, 2002-2004 for M. V. de Hoop for “Advanced Engineering Mathematics” (MACS348) and “Linear Algebra” (MACS332) at the Colorado School of Mines.
- Completed SYGN600 course, Fundamentals of College Teaching.
- Teaching Assistant, Spring 2001 for the Department of Geophysics summer field camp (third year undergraduate students), Colorado School of Mines with faculty instructor M. L. Batzle.

Service

- Referee for Wave Motion, referee and guest editor for Geophysics.
- One of four organizers of the Women in Geophysics Mentoring Program in the Geophysics Department at the Colorado School of Mines, 2003-2005.
- Geophysics student representative to the Graduate Student Association of the Colorado School of Mines, 2002-2004.
- Student representative to the Research Council of the Colorado School of Mines, 2002-2004.
- Organizer of the Center for Wave Phenomena weekly seminar, 2003-2004.