

## **Michael A. Slawinski**

Professor: Mathematical seismology  
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## **Academic Appointments**

### **Primary**

2005 – present: Professor, Department of Earth Sciences, Memorial University, Canada  
2001 – 2005: Associate Professor, Department of Earth Sciences, Memorial University, Canada  
1997 – 2001: Assistant Professor (Industrial Research Chair), Department of Mechanical and Manufacturing Engineering, University of Calgary, Canada

### **Other**

2011 – present: Visiting Professor, Department of Mathematics, Politecnico di Milano, Italy  
2014 – 2017: Visiting Professor, Department of Geoinformatics and Applied Computer Science, AGH University of Science and Technology, Cracow, Poland  
2009 – 2011: Visiting Research Collaborator, Department of Geosciences, Princeton University, USA  
2008 : Visiting Scholar, Berkeley Seismological Laboratory, University of California, Berkeley, USA  
2001 – 2007: Petro-Canada Research Chair in Applied Seismology, Department of Earth Sciences, Memorial University, Canada  
2000 – 2005: Adjunct Professor, Department of Mathematics and Statistics, University of Calgary, Canada  
1997 – present: Director, The Geomechanics Project

## **Research Leadership**

### **The Geomechanics Project**

The Geomechanics Project was created in 1997 by Michael A. Slawinski with industrial sponsorship and a support of the University of Calgary. Slawinski has been the director of The Project since its inception.

Originally, The Project was hosted at the University of Calgary, in the Department of Mechanical Engineering. Since 2001, The Project is in the Department of Earth Sciences at Memorial University in St. John's, where Slawinski became the Petro-Canada Research Chair in Applied Seismology.

The Geomechanics Project is an interdisciplinary research group composed of graduate students, postdoctoral fellows and research associates from physics, mathematics and computer science. Their work focuses on inverse problems and material properties, within continuum mechanics, with emphasis on elasticity theory and its generalizations.

## Research funding

The research funding of Michael A. Slawinski for almost two decades has been in the context of The Geomechanics Project. The sources of his funding—which allows for the support of graduate students, postdoctoral fellows and visiting scholars as well as for research trips and acquisition of computer equipment—are academic, governmental and industrial; these funds are received in both North America and Europe.

## Industrial Experience

1997: Senior Geophysicist, Petro-Canada Oil and Gas, Calgary, Canada

1996 – 1997: Geophysicist, PanCanadian Petroleum Limited, Calgary, Canada

1993 – 1995: Geophysicist (Special Projects), Talisman Energy Inc., Calgary, Canada

1988 – 1992: Geophysicist, Chevron Canada Resources, Calgary, Canada

1987: Geophysicist, Husky Oil Operations, Calgary, Canada

1985 – 1986: Geophysicist, Gulf Canada Corporation, Calgary, Canada

## Education

1992 – 1996, Ph.D.: Seismic anisotropy; 'On elastic-wave propagation in anisotropic media: Reflection/refraction laws, raytracing and travelttime inversion', University of Calgary, Canada

1986 – 1988, M.Sc.: Seismic anelasticity; 'Investigation of inhomogeneous body waves in an elastic/anelastic medium', University of Calgary, Canada

1982 – 1985, B.Sc.: Geophysics, University of Calgary, Canada

1981 – 1982, DEUG (Diplôme d'études universitaires générales): Université de Paris XI, France

## Publications

**In most publications stated below, multiple authors are listed alphabetically**

### Books

#### Published

Slawinski, M.A. (2020) *Waves and rays in elastic continua* (Fourth edition) World Scientific ISBN: 978-981-122-640-3 (hardcover) ISBN: 978-981-122-642-7 (ebook) 680 pages

Slawinski, M.A. (2020) *Waves and rays in seismology: Answers to unasked questions* (Third edition) World Scientific ISBN: 978-981-122-643-4 (hardcover) ISBN: 978-981-122-645-8 (ebook) 650 pages

Bóna, A., Slawinski, M.A. (2020) *Wavefronts and rays as characteristics and asymptotics* (Third edition) World Scientific ISBN: 978-981-122-646-5 (hardcover) ISBN: 978-981-122-648-9 (ebook) 356 pages

Slawinski, M.A. (2018) *Waves and rays in seismology: Answers to unasked questions* (Second edition) World Scientific ISBN: 978-981-3239-87-6 ISBN: 978-981-3270-96-1(pbk), 544 pages

Brown, R.J., Slawinski, M.A. (2017) *On foundations of seismology: Bringing idealization down to Earth.* World Scientific ISBN: 978-9814329491, 161 pages

Slawinski, M.A. (2016) *Waves and rays in seismology: Answers to unasked questions.* World Scientific ISBN 978-9814644808, 380 pages

Bóna, A., Slawinski, M.A. (2015) *Wavefronts and rays as characteristics and asymptotics* (Second edition) World Scientific ISBN: 978-981-4644-78-5 ISBN: 978-981-4644-79-2(pbk), 319 pages

Slawinski, M.A. (2015) *Waves and rays in elastic continua* (Third edition) World Scientific: ISBN: 978-981-4641-75-3 ISBN: 978-981-4641-76-0(pbk), 621 pages

Bóna, A., Slawinski, M.A. (2011) *Wavefronts and rays as characteristics and asymptotics.* World Scientific ISBN: 978-9814295512, 276 pages

Slawinski, M.A. (2010) *Waves and rays in elastic continua* (Second edition of 'Seismic waves and rays in elastic media') World Scientific ISBN: 978-9814289009, 583 pages

Slawinski, M.A. (2003) *Seismic waves and rays in elastic media.* Elsevier/Pergamon ISBN: 0-080439306, 401 pages

#### In preparation

Bicycle power meters: Mathematical models.

Elements of tensor analysis: Modern treatise for physicists and engineers.  $\approx$  400 pages

## Chapters in books

### Published

Antonelli, P.L., Rutz, S.F., Slawinski, M.A. (2003) A geometrical foundation for seismic ray theory based on modern Finsler geometry: Finsler Lagrangian and Lagrange Geometries. Kluwer, ISBN 1-4020-1390-6, 9–54

## Papers in Peer-reviewed Journals

### Published

Danek, T., Gierlach, B., Kaderali, A., Slawinski, M.A., Stanoev, T. (2021) Selecting velocity models using Bayesian Information Criterion. *Geophysical Prospecting* <http://doi.org/10.1111/1365-2478.13153>

Bos, L., Slawinski, M.A., Stanoev, T., Vianello, M. (2020) On orthogonal transformations of the Christoffel equations. *International Journal on Geomathematics* **11**(6)

Dalton, D.R., Meehan, T., Slawinski, M.A. (2019) On Backus average in modelling guided waves. *Journal of Applied Geophysics* **170**(103815)

Bos, L., Slawinski, M.A., Stanoev, T. (2019) On Christoffel roots for nondetached slowness surfaces. *Geophysical Prospecting* **67**(9), 2280–2286

Bos, L., Slawinski, M.A., Stanoev, T. (2019) On the Backus average of layers with randomly oriented elasticity tensors. *Zeitschrift für angewandte Mathematik und Physik* **70**(84)

Bos, L., Dalton, D.R., Slawinski, M.A. (2019) On commutativity and near commutativity of translational and rotational averages: Analytical proofs and numerical examinations. *Journal of Elasticity* **136**, 189–206

Danek, T., Noseworthy, A., Slawinski, M.A. (2018) Effects of norms on general Hookean solids for their isotropic counterparts. *Dolomites Research Notes on Approximation* **11**, 15–28

Bos, L., Danek, T., Slawinski, M.A., Stanoev, T. (2018) Statistical and numerical considerations of Backus-average product approximation. *Journal of Elasticity* **132**(1), 141–159

Dalton, D.R., Slawinski, M.A., Stachura, P., Stanoev, T. (2017) Sensitivity of Love and quasi-Rayleigh waves to model parameters. *The Quarterly Journal of Mechanics and Applied Mathematics* **70**(2), 103–130

Bos, L., Dalton, D.R., Slawinski, M.A., Stanoev, T. (2017) On Backus average for generally anisotropic layers. *Journal of Elasticity* **127**(2), 179–196

Danek, T., Slawinski, M.A. (2016) Backus average under random perturbations of layered media. *SIAM Journal on Applied Mathematics* **76**(4), 1239–1249

Danek, T., Slawinski, M.A. (2015) On choosing effective elasticity tensors using a Monte-Carlo method. *Acta Geophysica* **63**(1), 45–61

- Danek, T., Kochetov, M., Slawinski, M.A. (2015) Effective elasticity tensors in context of random errors. *Journal of Elasticity* **121**(1), 55–67
- Bos, L., Slawinski, M.A. (2015) 2-norm effective isotropic Hookean solids. *Journal of Elasticity* **120**(1), 1–22
- Danek, T., Slawinski, M.A. (2014) On effective transversely isotropic elasticity tensors of Frobenius and  $L_2$  operator norms. *Dolomites Research Notes on Approximation* **7**
- Danek, T., Kochetov, M., Slawinski, M.A. (2013) Uncertainty analysis of effective elasticity tensors using quaternion-based global optimization and Monte-Carlo method. *The Quarterly Journal of Mechanics and Applied Mathematics* **66**(2), 253–272
- Bos, L., Slawinski, M.A. (2013) On the relationship between ray theory and the banana-doughnut formulation. *International Journal on Geomathematics* **4**(1), 55–65
- Danek, T., Slawinski, M.A. (2012) Bayesian inversion of VSP traveltimes for linear inhomogeneity and elliptical anisotropy. *Geophysics* **77**(6), 239–243
- Epstein, M., Peter, D., Slawinski, M.A. (2012) Combining raytracing techniques and finite-element modeling in deformable media. *The Quarterly Journal of Mechanics and Applied Mathematics* **65**(1), 87–112
- Bos, L., Slawinski, M.A. (2011) Proof of validity of first-order seismic traveltime estimates. *International Journal on Geomathematics* **2**(2), 255–263
- Diner, Ç., Kochetov, M., Slawinski, M.A. (2011) Identifying symmetry classes of elasticity tensors using monoclinic distance function. *Journal of Elasticity* **102**(2), 175–190
- Diner, Ç., Kochetov, M., Slawinski, M.A. (2011) On choosing effective symmetry class for elasticity tensors. *The Quarterly Journal of Mechanics and Applied Mathematics* **64**(1), 57–74
- Bos, L., Slawinski, M.A. (2010) Regions of invalidity of ray-centered coordinates. *The Quarterly Journal of Mechanics and Applied Mathematics* **63**(2), 227–236
- Bos, L., Slawinski, M.A. (2010) Elastodynamic equations: Characteristics, wavefronts and rays. *The Quarterly Journal of Mechanics and Applied Mathematics* **63**(1), 23–37
- Bucataru, I., Slawinski, M.A. (2009) On convexity and detachment of innermost wavefront-slowness sheet. *Geophysics* **74**(5), 63–66
- Kochetov, M., Slawinski, M.A. (2009) Estimating effective elasticity tensors from Christoffel equations. *Geophysics* **74**(5), 67–73
- Kochetov, M., Slawinski, M.A. (2009) On obtaining effective orthotropic elasticity tensors. *The Quarterly Journal of Mechanics and Applied Mathematics* **62**, 149–166
- Bucataru, I., Slawinski, M.A. (2009) Invariant properties for finding distance in space of elasticity tensors. *Journal of Elasticity* **94**(2), 97–114
- Kochetov, M., Slawinski, M.A. (2009) On obtaining effective transversely isotropic elasticity tensors. *Journal of Elasticity* **94**(1), 1–13
- Bóna, A., Slawinski, M.A., Smith, P. (2009) Ray tracing by simulated annealing: Bending method. *Geophysics* **74**(2), 25–32

- Bóna, A., Bucataru, I., Slawinski, M.A. (2008) Space of  $SO(3)$ -orbits of elasticity tensors. *Archives of Mechanics* **60**(2), 121–136
- Bóna, A., Bucataru, I., Slawinski, M.A. (2008) Inversion of ray velocity and polarization for elasticity tensor. *Journal of Applied Geophysics* **65**, 1–5
- Bóna, A., Slawinski, M.A. (2008) Comparison of two inversions for elasticity tensor. *Journal of Applied Geophysics* **65**, 6–9
- Bóna, A., Bucataru, I., Slawinski, M.A. (2007) Coordinate-free characterization of the symmetry classes of elasticity tensors. *Journal of Elasticity* **87**(2-3), 109–132
- Bóna, A., Bucataru, I., Slawinski, M.A. (2007) Material symmetries versus wavefront symmetries. *The Quarterly Journal of Mechanics and Applied Mathematics* **60**(2), 73–84
- Rogister, Y., Slawinski, M.A. (2005) Analytic solution of ray-tracing equations for a linearly inhomogeneous and elliptically anisotropic velocity model. *Geophysics* **70**(5), D37–D41
- Bucataru, I., Slawinski, M.A. (2005) Generalized orthogonality between rays and wavefronts in anisotropic inhomogeneous media. *Nonlinear analysis: Series B Real-world applications* **6**, 111–121
- Bóna, A., Bucataru, I., Slawinski, M.A. (2004) Characterization of elasticity-tensor symmetries using  $SU(2)$ . *Journal of Elasticity* **75**(3), 267–289
- Bóna, A., Bucataru, I., Slawinski, M.A. (2004) Material symmetries of elasticity tensors. *The Quarterly Journal of Mechanics and Applied Mathematics* **57**(4), 583–598
- Slawinski, M.A., Wheaton, C.J., Powojowski, M. (2004) VSP traveltimes inversion for linear inhomogeneity and elliptical anisotropy. *Geophysics* **69**(2), 373–377
- Bos, L., Gibson, P.C., Kochetov, M., Slawinski, M.A. (2004) Classes of anisotropic media: A tutorial. *Studia Geophysica and Geodætica* **48**, 265–287
- Slawinski, M.A., Lamoureux, M.P., Slawinski, R.A., Brown, R.J. (2003) VSP traveltimes inversion for anisotropy in a buried layer. *Geophysical Prospecting* **51**, 131–139
- Bóna, A., Slawinski, M.A. (2003) Fermat’s principle for seismic rays in elastic media. *Journal of Applied Geophysics* **54**, 445–451
- Antonelli, P.L., Bóna, A., Slawinski, M.A. (2003) Seismic rays as Finsler geodesics. *Nonlinear analysis: Series B Real-world applications* **4**(5), 711–722
- Ait-Haddou, R., Biard, L., Slawinski, M.A. (2002) Minimizing blossoms under symmetric linear constraints. *Computer Aided Geometric Design* **19**, 421–431
- Bóna, A., Slawinski, M.A. (2002) Raypaths as parametric curves in anisotropic, nonuniform media: Differential-geometry approach. *Nonlinear analysis: Series A Theory and methods* **51**, 983–994
- Hanyga, A., Slawinski, M.A. (2001) Caustics in  $qSV$  rayfields of transversely isotropic and vertically inhomogeneous media. *Anisotropy 2000: SEG (Special Issue)*, 409–418
- Slawinski, M.A., Slawinski, R.A., Brown, R.J., Parkin, J.M. (2000) A generalized form of Snell’s law in anisotropic media. *Geophysics* **65**(2), 632–637
- Ait-Haddou, R., Biard, L., Slawinski, M.A. (2000) Minkowski isoperimetric-hodograph curves. *Computer Aided Geometric Design* **17**, 835–861

- Monagan, M.B., Slawinski, M.A. (1999) The sensitivity of travelttime inversion for an anisotropic parameter in seismology. *MapleTech* **5**(2/3), 107–116
- Epstein, M., Slawinski, M.A. (1999) On raytracing in constant velocity-gradient media: Geometrical approach. *Canadian Journal of Exploration Geophysics* **35**(1/2), 1–6
- Epstein, M., Slawinski, M.A. (1999) On rays and ray parameters in inhomogeneous isotropic media. *Canadian Journal of Exploration Geophysics* **35**(1/2), 7–19
- Slawinski, R.A., Slawinski, M.A. (1999) On raytracing in constant velocity-gradient media: Calculus approach. *Canadian Journal of Exploration Geophysics* **35**(1/2), 24–27
- Slawinski, M.A., Webster, P.S. (1999) On generalized ray parameters for vertically inhomogeneous and anisotropic media. *Canadian Journal of Exploration Geophysics* **35**(1/2), 28–31
- Epstein, M., Slawinski, M.A. (1998) On some aspects of the continuum-mechanics context. *Revue de l'Institut Français du Pétrole* **53**(5), 669–677
- Slawinski, M.A. (1997) Angle of incidence as a function of source-receiver offset over a dipping reflector: An exact expression for VSP applications. *Canadian Journal of Exploration Geophysics* **33**(1/2), 66–69
- Slawinski, M.A., Parkin J.M. (1996) Migration of a multioffset VSP: A case study in NE British Columbia. *Canadian Journal of Exploration Geophysics* **32**(2), 104–112 (This paper is also included in the CSEG special volume on 'Depth Imaging of Foothills Seismic Data' ISBN 0-9692354-1-0, 136–144)
- Krebes, E.S., Slawinski M.A. (1991) On raytracing in an elastic-anelastic medium. *Bulletin of the Seismological Society of America* **81**(2), 667–686

### Submitted/Resubmitted

- Bos, L., Slawinski, M.A., Slawinski, R.A., Stanoev, T. (2022) Modelling of a cyclist's power for timetrials on a velodrome. *Sports Engineering* SPEN-D-22-00010R1

### arXiv

- Bos, L., Slawinski, M.A., Slawinski, R.A., Stanoev, T. (2023) Modelling of a cyclist's power for timetrials on a velodrome, 2201.06788 [physics.class-ph]
- Bos, L., Slawinski, M.A., Slawinski, R.A., Stanoev, T. (2021) Modelling of cyclist's power to overcome dissipative forces on a velodrome, 2110.15195 [physics.pop-ph]
- Danek, T., Gierlach, B., Kaderali, A., Slawinski, R.A., Stanoev, T. (2020) Selecting velocity models using Bayesian Information Criterion 2012.12812 [physics.geo-ph]
- Bos, L., Slawinski, M.A., Slawinski, R.A., Stanoev, T. (2020) On modelling bicycle power for velodromes: Part II Formulation for individual pursuits, 2009.01162 [physics.app-ph]
- Bos, L., Slawinski, M.A., Stanoev, T. (2020) On maximizing VAM for a given power: Slope, cadence, force and gear-ratio considerations, 2006.15816 [physics.pop-ph]

- Slawinski, M.A., Slawinski, R.A., Stanoev, T. (2020) On modelling bicycle power for velodromes: Part I Formulation for individual pursuits, 2005.04691 [physics.pop-ph]
- Danek, T., Slawinski, M.A., Stanoev, T. (2020) On modelling bicycle power-meter measurements: Part II. Relations between rates of change of model quantities, 2005.04480 [physics.pop-ph]
- Danek, T., Slawinski, M.A., Stanoev, T. (2020) On modelling bicycle power-meter measurements: Part I. Estimating effects of air, rolling and drivetrain resistance, 2005.04229 [physics.pop-ph]
- Dalton, D.R., Slawinski, M.A., Stanoev, T. (2019) Guided waves as superposition of body waves, 1903.05200 [physics.class-ph]
- Bos, L., Slawinski, M.A., Stanoev, T. (2019) On Christoffel roots for nondetached slowness surfaces, 1903.02514 [physics.geo-ph]
- Bos, L., Slawinski, M.A., Stanoev, T., Vianello, M. (2019) On orthogonal transformations of Christoffel equations, 1901.03926 [physics.geo-ph]
- Bos, L., Danek, T., Slawinski, M.A., Stanoev, T. (2018) Statistical and numerical considerations of Backus-average product approximation, 1704.03496 [physics.geo-ph]
- Melnikov, A., Slawinski, M.A. (2018) On deformation-gradient tensors as two-point tensors in curvilinear coordinates, 1807.04624 [physics.class-ph]
- Bos, L., Slawinski, M.A., Stanoev, T. (2018) On the Backus average of layers with randomly oriented elasticity tensors, 1804.06891 [physics.geo-ph]
- Adamus, F.P., Slawinski, M.A., Stanoev, T. (2018) On effects of inhomogeneity on anisotropy in Backus average, 1802.04075 [physics.geo-ph]
- Dalton, D.R., Meehan, T., Slawinski, M.A. (2018) On Backus average in modelling guided waves, 1801.05464 [physics.geo-ph]
- Bogacz, A., Dalton, D.R., Danek, T., Miernik, K., Slawinski, M.A. (2018) On Pareto Joint Inversion of guided waves, 1712.09850 [physics.geo-ph]
- Bos, L., Dalton, D.R., Slawinski, M.A. (2017) On commutativity and near commutativity of translational and rotational averages: Analytical proofs and numerical examinations, 1704.05541 [physics.geo-ph]
- Dalton, D.R., Slawinski, M.A. Stachura, P., Stanoev, T. (2017) Sensitivity of Love and quasi-Rayleigh waves to model parameters, 1703.10944 [physics.geo-ph]
- Dalton, D.R., Slawinski, M.A. (2016) Numerical examination of commutativity between Backus and Gazis et al. averages, 1609.01034 [physics.geo-ph]
- Dalton, D.R., Slawinski, M.A. Stachura, P., Stanoev, T. (2016) Forward problem for Love and quasi-Rayleigh waves: Exact dispersion relations and their sensitivities, 1607.07279 [physics.geo-ph]
- Danek, T., Noseworthy, A., Slawinski, M.A. (2016) On closest isotropic tensors and their norms, 1604.03833 [physics.geo-ph]
- Dalton, D.R., Slawinski, M.A. (2016) On commutativity of Backus and Gazis averages, 1601.02969 [physics.geo-ph]

Dalton, D.R., Slawinski, M.A. (2016) On Backus average for oblique incidence, 1601.02966 [physics.geo-ph]

Bos, L., Dalton, D.R., Slawinski, M.A., Stanoev, T. (2016) On Backus average for generally anisotropic layers, 1601.02967 [physics.geo-ph]

Bóna, A., Diner, Ç., Kochetov, M., Slawinski, M.A. (2010) On symmetries of elasticity tensors and Christoffel matrices, 1011.4975 [physics.geo-ph]

Bos, L., Slawinski, M.A. (2010) Proof of validity of first-order travel estimates, 1003.2704 [physics.geo-ph]

Bucataru, I., Slawinski, M.A. (2007/2008) Invariant properties for finding distance in space of elasticity tensors, 0712.1082 [cond-mat.mtrl-sci]

## Invited Papers

Slawinski, M.A. (2014) On Hookean solids in seismology: anisotropy and fractures. Canadian Society of Exploration Geophysicists Recorder **39**(2), 24–31

Wheaton, C.J., Slawinski, M.A. (2003) VSP reflection points for linear inhomogeneity and elliptical anisotropy. Canadian Society of Exploration Geophysicists Recorder **28**(7), 49–52

Slawinski, M.A. (2002) On seismic waves in linearly elastic, anisotropic and nonuniform continua. Canadian Society of Exploration Geophysicists Recorder **27**(1), 40–47

## Translations with Comments

Helbig, K., Slawinski, M.A. (2003): Rudzki, M.P. (1911) Parametrische Darstellung der elastischen Welle in anisotropischen Medien/ Parametric representation of the elastic wave in anisotropic media. Journal of Applied Geophysics **54**, 165–183

Slawinski, M.A. (2000): Rudzki, M.P. (1913) Essai d'application du principe de Fermat aux milieux anisotropes / On application of Fermat's principle to anisotropic media. Anisotropy 2000: Fractures, converted waves, case studies: Society of Exploration Geophysicists (Special Issue), 13–20

## Scientific Editing

Tsvankin, I., Grechka, V. (2010) Seismology of azimuthally anisotropic media and seismic fracture characterization. Society of Exploration Geophysicists, ISBN 978-1-56080-228-0

Freedon, W. (2010) Metaharmonic lattice point theory. Taylor and Francis Group, ISBN 9781439861844

Mathematical Reviews: [www.ams.org](http://www.ams.org)

## Keynote Lectures

‘On analogies and approximations of phenomenological models’ Constructive Approximation of Functions: Conference in honour of professor Stefano De Marchi’s 60th birthday, Faculty of Mathematics and Computer Science, Jagiellonian University, Cracow, Poland (February, 2023)

‘Blaski i cienie dziedzictwa akademickiego w historii nauki/Lights and shadows of academic heritage in history of science’ University of Warsaw, Poland (August, 2019)

‘Michał Szubert i siedem pokoleń jego rodziny zakorzenionych w naukach przyrodniczych/Michał Szubert and seven generations of his family rooted in natural sciences’ Bicentennial celebration: University of Warsaw, Poland (September, 2018)

‘On Hookean solids as analogies for seismic behavior of rocks’ 17th International Workshop on Seismic Anisotropy (17IWSA), Horseshoe Bay, TX, USA (September, 2016)

## Invited Lectures

‘Power for the Hour: Mathematical modelling of performance on velodromes’ Human Performance Laboratory, Faculty of Kinesiology, University of Calgary, Canada (April, 2023)

‘Power for the Hour: Mathematical modelling of performances on velodromes’ Department of chemistry and physics, Mount Royal University, Calgary, Canada (February, 2023)

‘Power for the Hour Revisited’ Workshop in honour of professor Maurizio Vianello’s 70th birthday, Department of engineering, University of Perugia, Italy (November, 2022)

‘Power for the Hour: Modelling of cyclist’s power for timetrials on a velodrome’ Department of mathematics, Politecnico di Milano, Italy (May, 2022)

‘On applied mathematical modelling’ Institute of mechanics and engineering (I2M), Université de Bordeaux INP, France (October, 2021)

‘Mathematical physics as analogy for empirical information: Epistemology and ontology’ Department of mathematics and informatics, Università di Palermo, Italy (October, 2019)

‘On Backus average as homogenization of discrete layers’ Department of mathematics, Politecnico di Milano, Italy (December, 2018)

‘On quantitative seismology: Theory and applications’ Paradigm – Exploration and production software, Tel Aviv, Israel (November, 2018)

‘On quantitative seismology: Approximate numerical solutions of ill-posed problems’, Università di Padova, Italy (June, 2018)

‘On quantitative seismology as paradigm for mathematical physics’ Department of mathematics, Università di Genova, Italy (September, 2017)

‘Historyczne i naukowe dygresje powiazań rodzinnych Jakuba Narkiewicza-Jodko’ Nadniemen, Belarus (August, 2017)

‘On foundations of seismology’ Department of mathematics, Università di Padova, Italy (July, 2017)

‘On mathematical analogies of physics: All models are wrong but some are useful’ Schlumberger Cambridge Research Centre, Cambridge, United Kingdom (April, 2017)

‘On elasticity-tensor symmetry: Material symmetry, symmetry-group average and spatial average’ Days on Diffraction Annual International Conference, Saint Petersburg, Russian Federation (June, 2017)

‘On nonlinear PDEs as quantitative models in seismology’ Program on Nonlinear PDEs, Vienna University of Technology (TU Wien), Austria (May, 2016)

‘On Backus averaging and its perturbations’ Department of mathematics, Politecnico di Milano, Italy (July, 2015)

‘Material properties and their quantitative models’ Géoazur, Université de Nice Sophia Antipolis, France (June, 2015)

‘Effective elasticity tensors and their norms in context of random errors’ Department of mathematics, Politecnico di Milano, Italy (December, 2014)

‘Quantitative/statistical analysis of anisotropic elasticity models in geophysics’ Eni S.p.A., Milan, Italy (October, 2014)

‘Symetrie ciał Hooke’a i wybór symetrii modelu/Symmetries of Hookean solids and model choice’ Department of Geoinformatics and Applied Computer Science, AGH University of Science and Technology, Cracow, Poland (June, 2014)

‘On implications of tensor-algebra properties in quantitative seismology’ Department of Mathematics and Statistics, Memorial University, St. John’s, NL, Canada (February, 2014)

‘Frobenius and induced norms of effective elasticity tensors’ Department of mathematics, Politecnico di Milano, Italy (December, 2013)

‘Obtaining effective elasticity tensors using quaternion-based global optimization’ Workshop on multivariate approximation in honour of professor Len Bos’s 60th birthday, Department of computer science, University of Verona, Italy (November, 2013)

‘Monte-Carlo analysis of Frobenius-norm effective elasticity tensors’ University of British Columbia: CSEG Symposium in honour of professor Tadeusz Ulrych, Vancouver, BC, Canada (September, 2013)

‘Measures of accuracy for anisotropic seismic models’ Géoazur, Université de Nice Sophia Antipolis, France (July, 2013)

‘Material-symmetry hierarchy of elasticity tensors using quaternion-based global optimization and Monte-Carlo method’ Department of mathematics, Politecnico di Milano, Italy (July, 2013)

‘Effective Hookean solids obtained by Monte-Carlo method’ Center for Wave Phenomena, Colorado School of Mines, Golden, CO, USA (February, 2013)

‘Uncertainty analysis of symmetry-plane orientations and elasticity parameters of Hookean solids’ Department of mathematics, Politecnico di Milano, Italy (July, 2012)

‘On quaternions in geophysics’ Department of Geosciences, Princeton University, Princeton, NJ, USA (December, 2011)

‘Foundations of theoretical seismology within continuum mechanics: physical considerations’ Department of Mechanical and Aerospace Engineering, Rutgers University, New Brunswick, NJ, USA (November, 2011)

‘Workshop on wave propagation in elastic continua’ Department of Mechanical, Materials and Manufacturing Engineering, University of Nottingham, UK (August, 2011)

‘Continuum mechanics and foundations of seismology: mathematical issues’ Department of mathematics, Politecnico di Milano, Italy (July, 2011)

‘On elasticity tensors: Material symmetries and distance among symmetries’ Department of mathematics, Politecnico di Milano, Italy (June, 2011)

‘Symmetries of elasticity tensors and resulting equations of motion’ Department of Mathematics and Statistics, Memorial University, St. John’s, NL, Canada (March, 2011)

‘Hookean solids as seismological media’ Department of Physics, University of Toronto, Toronto, ON, Canada (November, 2010)

‘On variational methods in seismology’ Department of Physics, University of Toronto, Toronto, ON, Canada (November, 2010)

‘On Hookean solids as proxies for physical materials’ Department of Mathematical and Computer Sciences, Colorado School of Mines, Golden, CO, USA (October, 2010)

‘Error sensitivity of effective elasticity tensors’ Kandilli Observatory and Earthquake Research Institute, Boğaziçi University, Istanbul, Turkey (June, 2010)

‘Error propagation in evaluating effective elasticity tensors’ Curtin University, Perth, Australia (June, 2010)

‘Deductive formulation of, and inferences from, seismology’ University of Auckland, Auckland, New Zealand (May, 2010)

‘Ray theory: Its status in context of theoretical seismology’ University of Hawaii at Manoa, Honolulu, HI, USA (April, 2010)

‘Elastodynamic equations: Characteristics and infinite-frequency approximation’ Mount Royal University, Calgary, AB, Canada (November, 2009)

‘On identifying elasticity tensors from seismic measurements:  $SO(3)$  - minimization problem’ Department of Mathematics and Statistics, University of Calgary, Calgary, AB, Canada (January, 2009)

‘On seismology as a branch of continuum mechanics’ Berkeley Seismological Laboratory, University of California, Berkeley, CA, USA (December, 2008)

‘On foundations of quantitative seismology’ Mount Royal College, Calgary, AB, Canada (November, 2008)

‘Hookean solids: Idealized representation of real materials’ Department of Physics, University of Toronto, Toronto, ON, Canada (November, 2008)

‘Finite- and infinite-frequency approximations in context of characteristic equations’ The Heritage of F.A. Dahlen, Seismological Society of America Annual Meeting, Santa Fe, NM, USA (April, 2008)

‘Material properties from seismic measurements’ Institut de Physique du Globe, Paris, France (January, 2008)

‘On ray theory in context of continuum mechanics: Constitutive equations as inverse problem in seismology’ Cambridge University: Meeting in honour of C.H. Chapman, Cambridge, England (May, 2007)

‘Hypotheticodeductive formulation of seismic ray theory’ Department of Philosophy, University of Toronto, Toronto, ON, Canada (October, 2006)

‘Tensorial invariants and symmetry classes’ Ecole et Observatoire des Sciences de la Terre, Université Louis Pasteur de Strasbourg, Strasbourg, France (June, 2006)

‘Symmetries of elasticity tensor as inverse problem’ Department of Geosciences, Princeton University, Princeton, NJ, USA (April, 2006)

‘Coordinate-free classification of elasticity tensor’ Department of Physics and Physical Oceanography, Memorial University, St. John’s, NL, Canada (March, 2006)

‘Symétries matérielles et symétries des fronts d’onde et de la polarisation/Material symmetries, and wavefront and polarization symmetries’ Ecole et Observatoire des Sciences de la Terre, Université Louis Pasteur de Strasbourg, Strasbourg, France (June, 2005)

‘Les principes de Fermat et de Maupertuis dans la théorie des rais sismiques/Fermat’s and de Maupertuis’s principles in seismic ray theory’ Ecole et Observatoire des Sciences de la Terre, Université Louis Pasteur de Strasbourg, Strasbourg, France (April, 2002)

‘Hamiltonian and Lagrangian formulations of seismic rays’ Department of Mathematics and Statistics, Memorial University, St. John’s, NL, Canada (March, 2002)

‘On differential-geometry formulations of geodesics and conserved quantities in ray theory for anisotropic, nonuniform media’ Department of Mathematical Sciences, University of Alberta, Edmonton, AB, Canada (January, 2001)

‘On positive-definiteness of the stiffness tensor and resulting stability inequalities’ Bureau of Geophysical Prospecting, China National Petroleum Corporation, Beijing, China (November, 2000)

‘On singularity theory in seismological applications’ Institute of Solid Earth Physics, University of Bergen, Bergen, Norway (May, 2000)

‘On caustic singularities in seismic ray theory’ Department of Mathematics and Statistics, University of Calgary, Calgary, AB, Canada (January, 2000)

‘On the ray forms and phase forms of the raypath parameter in hexagonal and linearly nonuniform continua’ Center for Wave Phenomena, Colorado School of Mines, Golden, CO, USA (November, 1999)

‘Sur les integrales premières des équations d’Euler-Lagrange dans le contexte sismologique/On first integrals of Euler-Lagrange equations in seismological context’ Institut Français du Pétrole, Paris, France (April, 1999)

‘On the symmetry systems and resulting invariance for wave phenomena’ Institute of Applied and Numerical Mathematics, Technische Universität, Vienna, Austria (March, 1999)

## Recognitions

Included in The Canadian Encyclopedia under “Philosophy: Logic, Epistemology, Philosophy of Science”

Elected to Gruppo Nazionale per la Fisica Matematica (GNFM), Italy

## Languages

English, French, Italian, Polish

## Citizenships

Canadian

Polish