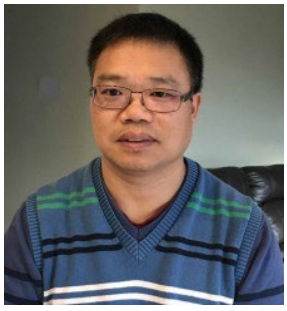
Pacific Institute for the Mathematical Sciences

PIMS Distinguished Speakers Series

DR. WENYUAN LIAO
Professor of Mathematics
University of Calgary



Title: Optimization, Adjoint Analysis and Full Waveform Inversion: From Theory to Real Applications

Full waveform inversion (FWI) is a novel seismic wave equation-based data-driven approach characterized by exploiting full waveform information from all types of seismic data. It can image the subsurface with high resolution, up to half the propagated wavelength. In particular, the shallow part of the earth model can be greatly enhanced, and the depth image can be significantly improved. However, FWI is a computationally intensive iterative process that requires many iterations. Therefore, it is essential to use an efficient local optimization gradient-based method, which requires accurate computation of the derivatives of the misfit function with respect to the model parameters. In this talk, I will briefly review the gradient-based method for constrained optimization problems and the adjoint analysis tools used in efficient gradient computation. Based on that, I will formulate the FWI problem as a PDE-constrained optimization problem and then solve it through the framework of the adjoint state method. Several numerical applications will be presented to demonstrate the effectiveness and robustness of the proposed computational framework.

Dr. Wenyuan Liao received a Ph.D. in Computational Mathematics from Mississippi State University in 2003. After graduation, he worked at Virginia Tech. as an NSF-funded Postdoctoral Fellow on the inverse problem of atmospheric models. In 2005, he moved to Canada and worked as a Postdoctoral fellow at McMaster University. In 2007, he joined the University of Calgary as a tenure-track faculty member and now is a professor in the Department of Mathematics and Statistics. He has served as the PIMS site director in Calgary since July 2022. Dr. Liao's research interests include numerical methods for PDEs, Mathematical theory and computational methods for inverse problems, seismic modelling, and inversion with applications in Geophysics

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12:00 PM – 1:00 PM
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