Pacific Institute *for the* Mathematical Sciences

Marsden Memorial Lecture
Melvin Leok
University of California, San Diego

March 24, 2023 | 2:30pm Pacific
University of Northern British Columbia
Room: NHSC 9-200 & Hybrid

The Connections Between Discrete Geometric Mechanics, Information Geometry, Accelerated Optimization and Machine Learning.
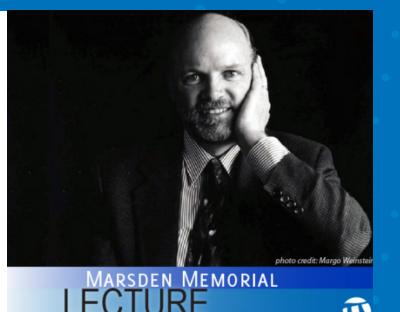
ABSTRACT:
Geometric mechanics describes Lagrangian and Hamiltonian mechanics geometrically, and information geometry formulates statistical estimation, inference, and machine learning in terms of geometry. A divergence function is an asymmetric distance between two probability densities that induces differential geometric structures and yields efficient machine learning algorithms that minimize the duality gap. The connection between information geometry and geometric mechanics will yield a unified treatment of machine learning and structure-preserving discretizations. In particular, the divergence function of information geometry can be viewed as a discrete Lagrangian, which is a generating function of a symplectic map, that arise in discrete variational mechanics. This identification allows the methods of backward error analysis to be applied, and the symplectic map generated by a divergence function can be associated with the exact time-h flow map of a Hamiltonian system on the space of probability distributions. We will also discuss how time-adaptive Hamiltonian variational integrators can be used to discretize the Bregman Hamiltonian, whose flow generalizes the differential equation that describes the dynamics of the Nesterov accelerated gradient descent method.

To attend via zoom, please fill the registration form *here* or request details from *alia.hamieh@unbc.ca*
Event details: *https://www.pims.math.ca/scientific-event/230324-mmlml*

ABOUT THE MARSDEN MEMORIAL LECTURES:

The Marsden Memorial Lecture Series is dedicated to the memory of Jerrold E Marsden (1942-2010), a world-renowned Canadian applied mathematician. Marsden was the Carl F Braun Professor of Control and Dynamical Systems at Caltech, and prior to that he was at the University of California (Berkeley) for many years. He did extensive research in the areas of geometric mechanics, dynamical systems and control theory. He was one of the original founders in the early 1970s of reduction theory for mechanical systems with symmetry, which remains an active and much studied area of research today.

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