



# Frontiers of Mathematics Lecture

## Mass transport, Kantorovich operators and their ergodic properties

### Abstract

The notion of a non-linear Kantorovich operator was motivated by the celebrated duality in the mass transport problem, hence the name. In retrospect, we realized that they -and their iterates- were omnipresent in several branches of analysis, even those that are focused on linear Markov operators and their semi-groups such as classical ergodic theory, potential theory, and probability theory. The Kantorovich operators that appear in these cases, though non-linear, are all positively 1-homogenous rendering most classical operations on measures and functions conducted in these theories “cost-free”. General Kantorovich operators arise when one assigns “a cost” to such operations.

Kantorovich operators are also Choquet capacities and are the “least non-linear” extensions of Markov operators, which make them a relatively “manageable” subclass of non-linear maps. Motivated by the stochastic counterpart of Aubry-Mather theory for Lagrangian systems and Fathi-Mather weak KAM theory, as well as ergodic optimization of dynamical systems, we study the asymptotic properties of general Kantorovich operators.

### Biography

Professor Nassif Ghoussoub is a Professor of Mathematics, and a “Distinguished University Scholar” at the University of British Columbia, Canada. He obtained his Doctorat d'état in 1979 from the Université Pierre et Marie Curie in Paris, France. His present research interests are in non-linear analysis and partial differential equations. He was the founding Director of PIMS (Pacific Institute for the Mathematical Sciences) for the period 1996-2003, a co-founder of the MITACS Network of Centres of Excellence (Mathematics of Information Technology and Complex Systems) and a member of its Board of Directors for the periods 1998-2003 and 2008-16. He is also the founder of BIRS (The Banff International Research Station) and has been its Scientific Director for the period 2004-2020. He was the recipient of the Coxeter-James prize in 1990, and of a Killam senior fellowship in 1992. In 2004, he was awarded a Doctorat Honoris Causa by the Université Paris-Dauphine, and in 2015, he was named Doctor of Science Honoris Causa by the University of Victoria. The Canadian Mathematical Society awarded him the Coxeter-James prize in 1990, the Jeffrey Williams Prize in 2007, and the David Borwein Distinguished Career Award in 2010. In 2019, he was awarded the CRM-Fields-PIMS prize by the three Canadian Math institutes. He was elected Fellow of the Royal Society of Canada in 1993, and was appointed Officer of the Order of Canada in December 2015. He became a Member of Académie des Sciences du Liban in 2020.



### Professor Nassif Ghoussoub

*(Department of Mathematics,  
The University of British Columbia)*

Date :  
March 15, 2024 (Friday)

Time :  
3:30 – 4:30pm  
(Tea Reception starts at 3:00 pm)

Venue :  
P3, Chong Yuet Ming Physics Building  
The University of Hong Kong