# Hong Kong - Singapore joint Seminar Series in Financial Mathematics/Engineering

## Set Valued HJB Equations

### Prof. Jianfeng Zhang
### University of Southern California

## Abstract

The set values have been introduced for many applications, such as time inconsistent stochastic optimization problems, multivariate dynamic risk measures, and nonzero sum games with multiple equilibria. Among others, one crucial property of the dynamic set value is the dynamic programming principle. In this talk we introduce a notion of set valued PDEs and show that the set value function of certain multidimensional control problem is the unique solution to the corresponding set valued HJB equation. A key tool is the set valued Ito formula, which together with the DPP induces the PDE. In the one dimensional case, the set valued PDE reduces back to the standard HJB equations. Our characterization of the set values is through their boundaries, which are manifolds. Thus our approach is intrinsically connected to the existing theory of moving/evolving manifolds, such as front propagation and mean curvature flows. Roughly speaking, those equations can be viewed as first order set valued ODEs, and we extend them to second order PDEs. Another difference is that, due to different applications, those equations are forward in time (with initial conditions), while we consider backward equations (with terminal conditions). The talk is based on an ongoing joint work with Melih Iseri.

## About the speaker

Prof. Jianfeng Zhang got his PhD degree in Mathematics from Purdue University in 2001. After the Postdoc in University of Minnesota, he joined USC in 2003 and is currently a full professor there. Prof. Zhang is a world leading expert in Stochastic Analysis and Numerical Analysis, especially in the stochastic control, BSDE theory and Math. Finance. He also serves in editor boards of various journals in the field.

## Date

Feb 10, 2023, Friday (HK SAR)

## Time

10:00 am– 11:00am (HK SAR)

## Zoom

https://cityu.zoom.us/j/99745825198?pwd=TCtXSkN2L2t6R05UZnZNaVVRaGZZdz09

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