AMENDMENT

The Hong Kong University of Science and Technology

Department of Mathematics

<u>Seminar on Applied Mathematics</u>

Orthogonal Matrix Retrieval in Cryo-Electron Microscopy

by

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<u>Abstract</u>

In single particle reconstruction (SPR) from cryo-electron microscopy (cryo-EM), the 3D structure of a molecule needs to be determined from its 2D projection images taken at unknown viewing directions. Zvi Kam showed already in 1980 that the autocorrelation function of the 3D molecule over the rotation group SO(3) can be estimated from 2D projection images whose viewing directions are uniformly distributed over the sphere. The autocorrelation function determines the expansion coefficients of the 3D molecule in spherical harmonics up to an orthogonal matrix of size $(2l+1)\times(2l+1)$ for each l=0,1,2,.... In this paper we show how techniques for solving the phase retrieval problem in X-ray crystallography can be modified for the cryo-EM setup for retrieving the missing orthogonal matrices. Specifically, we present two new approaches that we term Orthogonal Extension and Orthogonal Replacement, in which the main algorithmic components are the singular value decomposition and semidefinite programming. We demonstrate the utility of these approaches through numerical experiments on simulated data.

Date:	**Thursday, 21 June 2018**
Time:	**9:30a.m. – 10:30a.m.**
Venue:	**Room 3472, Academic Buildings (Lifts 25, 26), HKUST**

All are welcome!