The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

New Provable Non-Convex Algorithms for Generalized Phase Retrieval

By

Miss Jiayi LI

ABSTRACT

This thesis addresses the critical challenge of generalized phase retrieval, which involves reconstructing a length-n signal from phaseless samples—a problem of great importance in fields such as X-ray crystallography, astronomy, quantum mechanics, and diffraction imaging. Despite the development of numerous prov- able algorithms, significant gaps in the underlying theories persist, particularly regarding convergence rates and practical applicability, especially in the context of the Coded Diffraction Pattern (CDP) model. To address these issues, we propose a unified framework for Riemannian gradient descent methods and in- troduce the Weighted Riemannian Gradient Descent (WRGD) algorithm, along with the Revised Truncated Amplitude Flow (RTAF) algorithm tailored for the CDP model. Our comprehensive theoretical analysis and numerical experiments demonstrate that these algorithms significantly improve convergence speeds com- pared to existing methods, thereby enhancing the practical applicability of phase retrieval techniques in signal reconstruction.

Date :	**3 Jan 2025, Friday**	
Time :	**3:00 pm**	
Venue :	**Room 4502 (Lifts 25/26)**	

Thesis Examination Committee:

Chairman	:	**Prof. Jiguang WANG, LIFS/HKUST**
Thesis Supervisor	:	**Prof. Jianfeng CAI, MATH/HKUST**
Thesis Supervisor	:	**Prof. Yang WANG, MATH/HKUST** *(via online mode)*
Member	:	**Prof. Dong XIA, MATH/HKUST**
Member	:	**Prof. Hai ZHANG, MATH/HKUST**
Member	:	**Prof. Haibin SU, CHEM/HKUST**
External Examiner	:	**Prof. Huaian DIAO, Dept of Computational Mathematical /Jilin University**

(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).