THE HONG KONG POLYTECHNIC UNIVERSITY
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DEPARTMENT OF APPLIED MATHEMATICS
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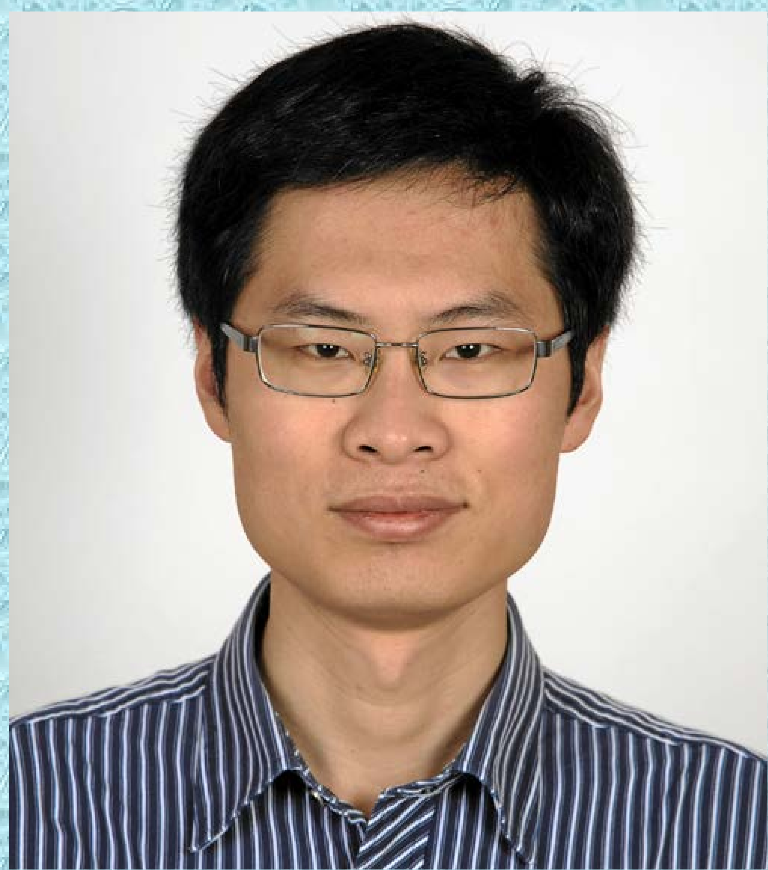

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Research interest:

- **Theory and algorithms of mathematical optimization**

Start-up grant project

Optimization by space decomposition

Abstract

This project aims to develop parallel algorithms for solving large-scale optimization problems with or without using derivatives. The key algorithmic technique that we will exploit is space decomposition. The output will be new theories of asymptotic global convergence and worst case complexity, and novel algorithms that are well adapted to modern computing environments and readily applicable to real-world problems. This study be conducted in collaboration with S. Gratton (IRIT/ENSEEIHT/INPT, France) and L. N. Vicente (University of Coimbra, Portugal).

The technique of decomposition is to divide a large problem into a sequence of relatively easy subproblems, and then solve them in some parallel or sequential manner. This methodology lies at the heart of many classical numerical algorithms, for instances, the Jacobi method and the Gauss-Seidel method. In optimization, space decomposition has been an important technique for solving large-scale problems. For example, the Block Coordinate Descent method (BCD), the Alternating Direction Method of Multipliers (ADMM), the Parallel Variable Distribution method (PVD), the Parallel Gradient Distribution method (PGD), and the Parallel Variable Transformation (PVT) method can all be regarded as space decomposition methods. In our study, we emphasize that parallel algorithms should be scalable in order to take full advantage of modern computers, and we consider space decomposition as an extension of the Domain Decomposition method, which enjoys fine scalability and has been successfully applied to numerical methods for PDEs and linear systems. Inspired by these perspectives, we propose a new subspace decomposition framework for nonlinear optimization, aiming to develop scalable parallel algorithms for large-scale optimization problems.