Department of Mathematics
The Chinese University of Hong Kong

數學系
香港中文大學

Phone: (852) 3943 7988 ● Fax: (852) 2603 5154 ● Email: dept@math.cuhk.edu.hk (Math. Dept.)
Room 220, Lady Shaw Building, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong

Seminar

Energy Decomposition with Applications to Operator Compression and Multi-resolution Matrix Decomposition

Dr. Jeffrey Ka Chun LAM

Computing & Mathematical Sciences
California Institute of Technology (Caltech)

Abstract

We propose an adaptive fast solver for a general class of symmetric positive definite (SPD) matrices which include the well-known graph Laplacian. We achieve this by developing an adaptive operator compression scheme and a multiresolution matrix factorization algorithm which achieve nearly optimal performance on both complexity and well-posedness. To develop our adaptive operator compression and multiresolution matrix factorization methods, we first introduce a novel notion of energy decomposition for SPD matrix A using the representation of energy elements. The interaction between these energy elements depicts the underlying topological structure of the operator. This concept of decomposition naturally reflects the hidden geometric structure of the operator which inherits the localities of the structure. By utilizing the intrinsic geometric information under this Energy framework, we propose a systematic operator compression scheme for the inverse operator A^{-1}. In particular, with an appropriate partition of the underlying geometric structure, we can construct localized basis by using the concept of interior and closed energy. Meanwhile, two important localized quantities are introduced, namely the error factor and the condition factor. Our error analysis results show that these two factors will be the guidelines for finding the appropriate partition of the basic functions such that prescribed compression error and acceptable condition number can be achieved. By virtue of this insight, we propose the Patch Pairing algorithm to realize our energy partition framework for operator compression with controllable compression error and condition number.

Date :   August 22, 2017 (Tuesday)
Time :   3:00p.m. – 4:00p.m.
Venue :   Room 219, Lady Shaw Building
             The Chinese University of Hong Kong

All are Welcome