



Numerical Analysis Seminar

Convergence of Restricted Additive Schwarz method with impedance transmission conditions for discretized Helmholtz problems

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Abstract

The Restricted Additive Schwarz method with impedance transmission conditions, also known as the Optimised Restricted Additive Schwarz (ORAS) method, is a simple overlapping one-level parallel domain decomposition method. It is implemented in PETSc and FreeFEM++ and has been successfully used as an iterative solver or a preconditioner for wave propagation problems. However, there remains limited rigorous convergence analysis of this method. This talk will revisit some background of the Helmholtz equation and some standard convergence theory for the iterative methods. Then I will present a novel convergence analysis for ORAS based on "power contractivity". The analysis starts by showing that ORAS is an unconventional finite element approximation of a classical parallel iterative Schwarz method, formulated at the PDE (non-discrete) level. This non-discrete Schwarz method was recently analyzed in [Gong, Gander, Graham, Lafontaine, Spence, arXiv 2106.05218]. Using a novel weighted finite-element error estimate for Helmholtz problems, we show that ORAS inherits the convergence properties of the Schwarz method, independent of polynomial order.

Date: March 23, 2022 (Wednesday)

Time: 4:00 - 5:00pm (Hong Kong Time)

Venue: ZOOM: <https://hku.zoom.us/j/>

Meeting ID: 913 6532 3891

Password: 310656