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ROBUST INCOMPLETE FACTORIZATION PRECONDITIONING FOR DOMAIN-DECOMPOSITION PARALLEL FEM

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This study proposes localized preconditioning techniques for iteratively solving linear system equations, which appear from the parallel finite element method based on the domain decomposition. The idea of the preconditioning originates in the Robust Incomplete Factorization (RIF)[1] and Improved RIF （IRIF)[2]. Since the system equations considered here are decomposed and distributed over the network, the incomplete factorization is done locally and one-level fill-in is considered there. The proposed method can determine the profile of non-zero entries of the preconditioning matrix before its construction. This is an advantageous point in view of the memory usage.
The proposed preconditioned conjugate gradient solver[3] has been implemented in the open-source parallel FEM program 'FrontISTR'[4,5], which stores a stiffness matrix in a 3x3 block compressed manner, and its effectiveness has been evaluated in parallel FE stress analysis of shell structures.

Figure 1 shows the convergence histories of CG solvers without preconditioning, conventional IC(0) and IC(1), and proposed methods, i.e. localized RIF(0) and localized RIF(1). Matrix is given from a shell structure of 918 nodes and 850 elements. Type of element is MITC4. Localized RIF(1) has shown superior preconditioning effect to IC(1). Especially, reduction of iteration numbers of localized RIF(1) compared with RIF(0) is remarkable. Results of larger scale problems and effect of domain decompositions will be shown at the presentation.

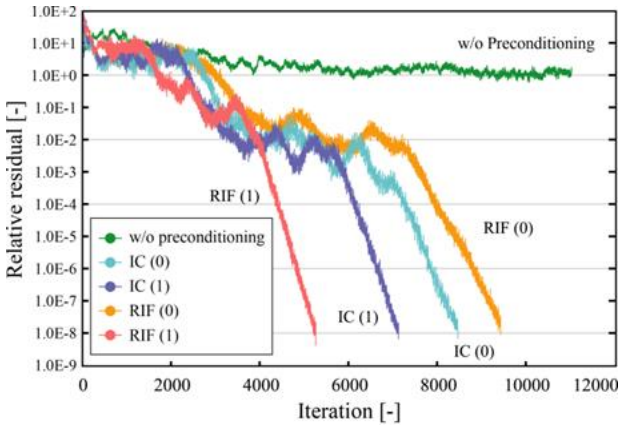

Figure 1: Convergence histories of CG solvers without preconditioning, conventional IC(0) and IC(1), and proposed methods, i.e. localized RIF(0) and localized RIF(1)

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