An Element-by-element Multilevel Block-ILU Preconditioner

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Context: Linear System Solving For Finite Element Method

Solving the large-scale element-structured sparse linear system

$$A\mathbf{x} = \mathbf{b},$$

which was derived from a finite element discretization, and where

$$A = \sum_{e \in \mathcal{E}} P_e A_e P_e^T,$$

with A_e the element matrix and P_e the standard local-to-global mapping.

Competition: Combine As Many Buzzwords As You Can In One Preconditioner

- finite element method,
- parallelizable,
- agglomerate,
- BLAS3,
- block-ILU,
- multifrontal method,
- preconditioner,
- multilevel,
- dense matrices,
- high-throughput,
- BLAS2,
- sparse matrix,
- local assembly,
- element matrices,
- high quality factorization,
- discard policy,
- element-by-element,
- LAPACK.

Numerical Result: Navier-Stokes Model Problem

- ILU(0): The standard no-fill ILU preconditioner.
- ILUT(p, τ): The dual-threshold preconditioner.
- ARMS(τ): The multilevel dual-threshold preconditioner.
- EBE-ML-ILU(k): The element-by-element multilevel preconditioner.

