
Matthias Bollhoefer
**Inverse-Based Multilevel ILU Preconditioners — Theory,
Applications and Software**

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We will present multilevel ILU strategies for large scale problems that are mainly based on keeping the inverse triangular factors bounded. This approach is based on combining several single components that finally form the multilevel algorithm.

1. The components cover reordering strategies like RCM, independent sets or a more recent strategy ddPQ [3], which partially reorders the matrix with respect to diagonal dominance and fill.
2. In the ILU part of the algorithm, the preprocessed matrix is partially factored using an inverse based ILU [1, 2] with diagonal pivoting that keeps the inverse triangular factors bounded. From the theoretical point of view this can be interpreted as keeping the approximate triangular factors L and U and their inverses close to each other.
3. The combination of the first two parts leads to a multilevel algorithm that repeatedly uses these templates.

The algorithm has been implemented in a new software package that includes treatment of general real and complex matrices as well as SPD matrices. The effectiveness of this approach using the package is demonstrated.

Bibliography

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