

Recycling Preconditioners and Subspaces for Sequences of Linear Systems

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Preconditioners are generally essential for fast convergence in the iterative solution of linear systems of equations, but computing a good preconditioner can be expensive. Therefore, it may be advantageous to recycle (update and reuse) preconditioners. In this talk, we discuss a simple and effective method for doing this by defining a map from one matrix to another closely related matrix for which we have a preconditioner. We combine this preconditioner with the map to define the new preconditioner. This update is independent from the original preconditioner and is generally inexpensive to compute, allowing us to amortize the potentially high cost of the original preconditioner over many systems. There is flexibility in balancing the quality of the map with the computational cost.

Recycling Krylov subspaces from previous systems is a complementary method for reducing computational cost. We examine the combination of recycling subspaces with recycling preconditioners, providing experimental analysis and numerical results. Applications include tomography, topology, model reduction, and others.

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