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A Comparison of Deflation and Coarse Grid Correction Applied to Porous Media Flow

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Abstract: We compare various preconditioners for the numerical solution of partial differential equations. We compare a coarse grid correction preconditioner used in domain decomposition methods with a so-called deflation preconditioner.
We prove that the effective condition number of the deflated preconditioned system is always, i.e. for all deflation vectors and all restrictions and prolongations, below the condition number of the system preconditioned by the coarse grid correction. This implies that the Conjugate Gradient method applied to the deflated preconditioned system converges always faster than the Conjugate Gradient method applied to the system preconditioned by the coarse grid correction.
Numerical results for porous media flows emphasize the theoretical results.

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