ALL-AT-ONCE MULTILEVEL ITERATION FOR BI-HARMONIC SYSTEM

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Introduction. We develop a multilevel-based iteration to solve a system of linear equations that approximates the biharmonic equation

$$Д^{2} 0 = / \text{ in } a \text{ c } жс^{2},$$

equipped with some boundary conditions on $\partial \breve{u}$. The matrix of coefficients in the system corresponds to an the equivalent coupled system, i.e.,

$$\mathcal{A} = \begin{bmatrix} \Delta & 0 \\ -\mathcal{I} & \Delta \end{bmatrix}.$$

Materials and methods. The multilevel iteration is based on the operator [1]

$$T = 0 - cAZE\text{-}^{1}Z^{T} + AnZS\text{^}Z,$$

incorporated in minimal-residual-type approximation, with the largest eigenvalue of $<A\,EW$ and Z: R^{n} ^$R^{m}, m<n$, and $£ = Z^{T}AZ.$

Results and discussion. An example of numerical solution at convergence $\left(\| \ldots \text{fcii} \ldots \| \leq 10^{-6}\right)$ (is shown in Figure 1 for "clamp"" boundary conditions. The convergence history is shown in Figure 2, indicating a superlinear convergence [2].

Conclusions. The iterative method converges at a rate that is independent of the mesh size. The rate of convergence is comparable to that of multigrid, but is achieved with simpler components.

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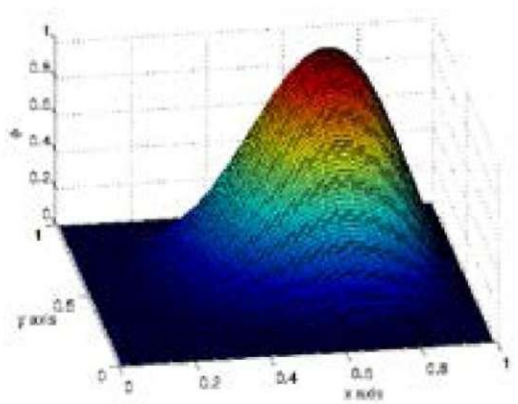

Figure 1.

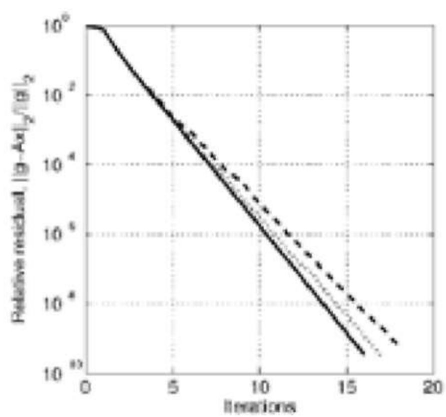

Figure 2.

References.

1. Multilevel Projection-based Nested Krylov Iteration for Boundary Value Problem, SIAM J. Sci. Comput. 30(3) pp. 1572-1595.
2. Y. Erlangga, All-at-once solution of the biharmonic equation using multilevel Krylov methods, submitted.