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REFEREE'S REPORT

Concurrency and Computation:Practice and Experience

A: General Information

Please return to:
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Please fill in Summary Conclusions (Sec. C) and details as appropriate in Secs. D, E and F.

B: Refereeing Philosophy

We encourage a broad range of readers and contributors. Please judge papers on their technical merit and separate comments on this from those on style and approach. Keep in mind the strong practical orientation that we are trying to give the journal. Note that the forms attached provide separate paper for comments that you wish only the editor to see and those that both the editor and author receive. Your identity will of course not be revealed to the author.

C: Paper and Referee Metadata

- Paper Number Cnnn:
- Date:

- Paper Title: **Automatic Determination of Matrix-Blocks**
- Author(s): Victor Eijkhout
- Referee: Ed D'Azevedo (email: e6d@ornl.gov)
- Address: Ed D'Azevedo, Computer Science and Mathematics Division, Oak Ridge National Laboratory, Bldg 6012, MS6367, Oak Ridge, TN 37831.

Referee Recommendations. Please indicate overall recommendations here, and details in following sections.

1. publish as is
2. accepted provided changes suggested are made
3. reject

My recommendation is reject or resubmit with major modifications.

D: Referee Comments (For Editor Only)

I feel the paper is not written well enough to convey to the reader what is the key problem and what is done to solve the problem. The paper could be improved if the author uses more precise definitions for terms and description of the algorithms. Some work is needed to hold the reader's attention by describing the impact or motivation of the problem.

E: Referee Comments (For Author and Editor)

Many PDE problems have multiple variable or degrees of freedom at each grid point (say u,v,w,p) and taking advantage of such dense block structures in the sparse matrix is key to achieving good performance. In this paper, the block structure refers to subdomains decretized by a regular stencil on a logically rectangular grid. The author suggests some heuristic to identify such subdomains based on the symmetrized graph structure but does not use numerical entries of the matrix.

The author might consider using matlab-like matrix notation to describe the intended algorithm, then separately address the issue of efficient implementation in a distributed memory parallel environment. The author might also specify what assumptions are made in the parallel implementation such say matrix is stored in compress block row format and the upper triangular part is distributed in block rows.

The author might consider giving definitions of some terms such as "split point" or "beginnings/endings" of blocks.

The impact of the automatic block repartition can be judged by the effectiveness of the preconditioner as given by number of iterations, and on the overall run time. The first can be determined even using MATLAB on a serial machine. The second issue has to take into account the effect of possible load imbalance or higher message volume. The author might also consider expanding the numerical experiments on more test cases perhaps obtained from the Fortran Market or the Harwell Boeing library. The author might comment on the class of problem (say finite difference on elliptic problem on a "brick" domain) that this heuristic might be useful.

The example problem used is based on a two-material problem (heat conduction?) with large differences in material properties. The discretization used for each material seems to product different sparsity pattern. If the same discretization technique were used on a similar grid (say both are logically rectangular grid with same grid dimensions), then the heuristic on automatic block detection that is based only on the graph structure would fail to identify the two sub-domains.

F: Presentation Changes

The author might consider adding a figure to describe the two-material problem used to generate the sparse matrices.

The author might help the reader by adding in the caption what the main point or what the reader should find or focus on each figure.